A Sustainability Assessment Framework for Waterfront Communities Increasing the Resilience of the Abu Qir Waterfront Community in Alexandria

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Abstract - It is predicted that the global phenomena of Climate change will have far reaching effects and implications on different local urban systems. For incidence, global average sea levels are expected to rise between 7 and 36 cm by the 2050s, and between 9 and 69 cm by the 2080s. Waterfront communities are the first to be affected by such impacts, putting them at high risk. Planning strategies are needed to assist these communities and increase their adaptive and learning capacities in the face of diverse challenges to their urban sub-systems.

The research investigates a number of sustainability frameworks and assessment rating systems for neighbourhoods and communities. It investigates the sustainable evaluation criteria carried out by three assessment rating systems. First is the LEED (Leadership in Energy & Environmental Design, USA), the second is the BREEAM (Building Research Establishment Environmental Assessment Method, UK), and the third is the Estidama PEARL rating system (UAE).Examples of waterfront communities which applied the previous rating systems are analysed in order to determine the applicability and relevance of these systems to waterfront communities in particular.

The research concludes with a proposed framework of indicators for waterfront communities. The similarities and differences between the three rating systems and featured indicators specific to waterfront planning applied in the analysed examples; yet absent in the three rating systems, have informed the selection of indicators in the proposed assessment framework. The proposed framework could be an effective tool for the planning and development of à waterfront community in the MENA (the port region). In order to validate the framework, the set of environmental and physical indicators were applied on the case study of Abu Qir waterfront, Alexandria, Egypt. Conclusions and recommendations are made that would enhance the resilience of this waterfront community and provide a comprehensive tool for its sustainable planning.

Keywords - waterfront communities, sustainability, rating systems, assessment framework.

I. INTRODUCTION

Waterfront regeneration is becoming one of the most celebrated practices of urban renewal in contemporary cities of the North. At the same time, developing regions have suffered prolonged inattention which lead to a gap between both (Giovinazzi & Moretti, 2010). Urban waterfronts throughout the world suffered a series of deteriorating conditions related to environmental, social and economic issues.

Some of these issues include changing land uses, large areas of derelict land, lack of services and affordable housing for communities, contaminated air, water and soil, lack of connectivity and inefficient transport. With increased awareness of impacts of climate change, cities are facing big challenges with environmental conditions accomanied by pressures that threaten urban systems to accommodate rapid growth and development. Planning for long term growth and increasing the resilience of urban areas in such a manner that addresses the number of crucial economic, environmental and social conditions is an important quest, more particularly for developing countries with surging population.

This paper addresses this quest through providing a framework of indicators to assess the environmental and physical aspects of water front communities. The paper is divided into six sections, following the introduction. The second section explores principles agreed upon for the sustainability of waterfronts. The third section analyses the three rating systems

designed for urban communities. Moreover, it organises the indicators of those systems according to common categories critically assessing the importance granted to each one. The fourth section explores some international examples and their use of the rating systems plus any appendages made. The fifth section applies a framework to the case study done the area designated at Abu Quir to uncover priority themes based on the inputs collected from the field survey together with the interviews conducted, in order to facilitate the sustainable planning of this waterfront community. Lessons learnt are drawn in the sixth section with concluding remarks that can be made use of by other MENA (the port region), any coastal areas.

II. PRINCIPLES OF SUSTAINABLE WATERFRONTS

In the context of the initiatives for the Global Conference on The Urban Future (Urban 21) held in Berlin in July 2000 (Hall and Pfeiffer, 2000) and in the course of the EXPO 2000 World Exhibition (Giovinazzi,2008), 10 Principles for a Sustainable Development of Urban Waterfront Areas were approved. These principles are shown in Table 1:

Table 1. Principles of Sustainable Waterfronts

Principles of sustainable waterfronts:
1 - Secure the quality of water and the environment
2 - Waterfronts are part of the existing urban fabric
3 - The historic identity gives character
4 - Mixed use is a priority
5 - Public access is a prerequisite
6 - Public participation is an element of sustainability
7 - Planning in public private partnerships speeds the process
8 - Waterfronts are long term projects
9 - Waterfronts profit from international networking
10 - Re-vitalization is an ongoing process

It is concluded from the set of principles of Urban 21 shown above that it offers general international concepts of sustainability that can be applied on waterfronts, specifically by methods which respect nature and human needs to make a vital waterfront. But an assessment tool is needed as an evaluative mechanism to measure the rate of sustainability. The following section will show such attempts. However, it must be noted that the rating systems could apply to any urban area ; and not particularly waterfront communities. It should be critically assessed whether the rating systems will fully consider the above-mentioned principles or not. If so, their applicability to waterfronts could be possible. Further to this step, their application on some examples of waterfront communities are studied in section 4.

III. SUSTAINABILITY ASSESSMENT RATING SYSTEMS

Sustainability has become an accepted meta narrative, almost certain to be integrated into any future scenario of development (Campbell, 1996). A lot of institutions in different cities began to call for applying the principles of sustainable development (WCED, 1987; IUCN, 1991;Bell & Morse,2008). Different approaches have been developed; these include assessment techniques, indicators, audits, footprint studies and ecological accounts (Munda, 2001; Rydin et al, 2003, Tanguay et al. 2009), all viewed as approaches translating a concept that is presumed to be agreed in principle into something workable on the ground (Owens and Cowell, 2002).

Assessment rating systems are considered an important approach which has become popular worldwide and even obligatory in some places to classify who would barely fulfill the requirements of sustainability and who would exceed it. Examples of these rating systems are the LEED (American system), BREEAM (European system), CASBEE (Japanese system), Green Star (Australian system), and Pearl (UAE system). Three rating systems will be analysed. LEED and BREEAM were selected in this study as they are the most commonly known rating systems, and the Pearl system as it is a rating system used in the Middle East (United Arab Emirates) which is similar to the Egyptian context.

A. LEED Indicators

LEED stands for Leadership in Energy and Environmental Design which is a green building rating system, originally developed in 1998 by the U.S. Green Building Council (USGBC) to provide a recognized standard for the construction industry for assessing the environmental sustainability of building designs. LEED for neighborhood development was later developed in 2007 and updated in 2009(USGBC,

2009).

B. *BREEAM Indicators*

BREEAM (Building Research Establishment's Environmental Assessment Method) is an environmental assessment method which was first addressed in 1990 for buildings to set the standard for best practice in sustainable design. Eventually, In 2002 BREEAM released and published a comprehensive framework for the early stage of development called, « A Sustainability Checklist for Developments », a common framework for developers and local authorities BREEAM Communities. (BRE, 2009).

C. *PEARL Indicators*

The Pearl Rating System for Estidama (which means sustainability in Arabic) is the first government initiative released in the Middle East region, by Estidama program of the Abu Dhabi Urban Planning Council in 2010. The Program includes a standard rating system for buildings, villas, and other neighborhoods. Its aim is to create more sustainable communities, cities and global enterprises, balancing between the four pillars of Estidama: environmental, economic, cultural and social. Estidama itself is also a part of Abu Dhabi's 20-year plan, known as « A Plan for Abu Dhabi 2030 » which attempts to redefine how a contemporary Arab city should look like to encourage sustainable growth and progress. (AbuDhabi Urban Planning Council, 2010)

D. Comparison between the Categories of the 3 Rating Systems

After analyzing the 3 previous rating systems, it is observed that there is a considerable overlap between the three systems and that they all include the same main categories shown in Table 2. These are community layout, buildings, transportation, water, energy, materials, waste, environment, and innovation (though the categories have different names within each rating system). On the other hand, each system still has its own particularities and definitions under each category. The similarities between the 3 rating systems are examined and the criteria for sustainability to be followed are collated in a framework. Five categories were reached.

The framework ,including the five categories, is set to assess the sustainability and resilience of waterfronts, and thus they can be applied in the case study of Abu Qir area .

Table2.demonstrates the common indicators between Pearl, BREEAM, and LEED rating systems (after grouping categories under headings devised by the researcher)

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Category	LEED Indicator		BREEAM Indicator		PEARL Indicator	
Community layout	**Smart Location & Linkage**	-Smart Location - Proximity to water & waste water infrastructure - Floodplain Avoidance - Brownfields Redevelopment - High Priority Brownfields Redevelopment - Site Design of Habitat /Wetland Conservation -Housing and Jobs Proximity -School Proximity - Conservation Management of Habitat or Wetlands --Open community - Compact Development - Diversity of Uses - Reduced Parking Footprint - Access to Surrounding Vicinity - Access to Public Spaces - Access to Active Spaces - Universal Accessibility - Community Outreach and Involvement	**Community / Place Shaping**	- Inclusive Communities - Community Consultation - Information / Ownership - Land Use - Form of Development - Open Space - Inclusive Design - Mix of Use	**Livable communities & Integrated Development**	-Integrated Development Strategy - Sustainable Building Guidelines - Community-Dedicated-Infrastructure-Basic Commissioning - Life Cycle Costing - Plan 2030 - Urban Systems Assessment - Provision of Amenities and Facilities - Outdoor Thermal Comfort Strategy - Neighborhood Connectivity - Open Space Network - Accessible Community Facilities - Community Walkability - Active Urban Environments - Travel Plan - Safe and Secure Community -Regionally Responsive Planning

Buildings		**Green Construction & Technology**	- Diversity of Housing Types - Affordable Rental Housing - Affordable For-Sale Housing -Construction Activity Pollution Prevention -LEED Certified Green Buildings - Energy Efficiency in Buildings - Reduced Water Use - Building Reuse and Adaptive Reuse -Reuse of Historic Buildings	**Buildings**	-Residential Buildings (CSH or EcoHomes) -Non-Domestic Buildings (BREEAM)	**Livable communities**	- Minimum Pearl Rated Buildings Within Communities -Housing Diversity
Transportation		**Neighborhood pattern & Design**	-Reduced Automobile Dependence -Walkable streets -Street Network -Transit facilities -Transportation demand management	**Transport**	- Public Transport - Cycling Requirements - Car Parking -Traffic Management	**Livablecommunities**	- Transit Supportive Practices
Environmental Issues	**Ecology**	**Green Construction & Technology**	- Imperiled Species and Ecological Communities - Wetland and Water Body Conservation - Agricultural Land Conservation - Minimize Site Disturbance Through Site Design. - Minimize Site Disturbance During Construction. - Contaminant Reduction in Brownfields Remediation - Heat Island Reduction - Solar Orientation	**Ecology & Resources**	- Ecological Survey - Biodiversity Action Plan - Native Flora - Wildlife Corridor - Pollution Issues - Land Remediation	**Natural Systems**	-Natural Systems Assessment -Natural Systems Protection -Natural Systems Design &Management Strategy -Reuse of Land -Remediation of Contaminated Land -Ecological Enhancement -Habitat Creation and Restoration -Food Systems -Improved Outdoor Thermal Comfort -Construction Environmental Management
	Water	**Green Construction & Technology**	-Stormwater Management	**Resources**	- Water Resources Management -Flood Risk Issues -Water Consumption Management	**Precious Water**	-Community Water Strategy -Building Water Guidelines -Water Monitoring and Leak Detection -Community Water Use Reduction: Landscaping -Community Water Use Reduction: Heat Rejection -Community Water Use Reduction: Water Features -Storm water Management -Water Efficient Buildings
	Energy	**Green Construction & Technology**	- On-Site Energy Generation - On-Site Renewable Energy Sources - District Heating & Cooling -Infrastructure Energy Efficiency	**Climate & Energy**	-Passive Design Principles -Energy Consumption Management -Infrastructure	**Resourceful Energy**	-Community Energy Strategy -Building Energy Guidelines -Energy Monitoring and Reporting -Community Strategies for Passive Cooling -Urban Heat Reduction -Efficient Infrastructure: Lighting -Efficient Infrastructure: District Cooling -Efficient Infrastructure: -Smart Grid Technology -Renewable Energy: Onsite -Renewable Energy:Offsite -Energy EfficientBuildings
	Waste	**Green Construction & Technology**	-Construction Waste Management -Comprehensive Waste Management	**Resources**	-Waste Management (Operation and Construction)	**StewardingMaterials**	- Basic Construction Waste Management - Basic Operational Waste Management - Improved Construction Waste Management - Improved Operational Waste Management - Organic Waste Management 2 - Hazardous Waste Management
	Materials	**Green Construction & Technology**	- Recycled Content in Infrastructure	**Resources**	-Impact of Materials	**Stewarding Materials**	-CCA Treated Timber Elimination -Modular Pavement & Hardscape Cover -Regional Materials -Recycled Materials -Reused or Certified Timber
Innovation		**Innovation**	-Innovation and Exemplary Performance -LEED Accredited Professional	**Business**	-Business Investment -Employment -Business Facilities -Connectivity	**Innovating Practice**	-Showcase of Regional & Cultural Practices -Innovating Practice -Sustainability Awareness

E. Comparison between the Weightings of Each Category in the 3 Rating Systems LEED, BREEAM and PEARL.

Table 3 shows the relative weights in each rating system according to five categories arrived at from the previous analysis. The weighting of each category is measured as a percentage of each system's total credit points.

Table 3. shows the relative weights in each rating system to the following main categories

Categories		LEED	BREEAM	Pearl
Community layout		43.5%	31%	13%
Buildings		16%	4%	10%
Transportation		11.5%	22%	1%
Environmental Issues	Water	8.5%	6.5%	24%
	Energy	5.5%	10.5%	25%
	Materials	1%	3%	7%
	Waste	2%	3%	4.5%
	Ecology	6.5%	15%	14%
Innovation		5.5%	5%	2%

It is shown in the table above that each system gives a different weighting to each category, as each region focuses mainly on one category more than the other in terms of the issues-at- stake and according to the policies or strategies of the region towards sustainability. LEED's main focus is on community layout reflecting the United States most common planning problems. BREEAM's main focus is on community layout and transportation.

PEARL's main focus is on environmental issues, specifically water and energy issues as the very hot weather and the scarce water resources are considered problems of main concern in the United Arab Emirates. Similarly, a new rating system for neighbourhoods has to be made for the Egyptian context as it is a different region with its own characteristics and own needs. Moreover, waterfront neighbourhoods have specific issues reflected in the principles outlined in section 3. The following section will examine some examples of waterfront communities which applied the three above - mentioned rating systems to deduce any aspects that had been added and how useful the indicators are.

IV. ANALYTICAL EXAMPLES OF WATERFRONT COMMUNITIES APPLYING SUSTAINABILITY RATING SYSTEMS

Three types of waterfront cities which apply the categories of the sustainability rating systems are studied and analyzed. The first example is the city of Toronto, Canada, which applied the guidelines of LEED rating system on West Don Lands waterfront community. The second is Media city, UK, which applied the guidelines of the BREEAM rating system on the waterfront area. The third is Abu Dhabi, UAE, which applied the guidelines of the PEARL rating system on Mina Zayed waterfront community. The framework previously discussed will be used to compare between these examples and their implementation to methods of sustainability.

The case studies were selected by a simple methodology which is demonstrating the principles of sustainability. This concept is seen in the 3 examples but with different applicability due to their location, and this is the reason for analyzing examples in three different regions to learn how each region dealt with its surrounding environment to be sustainable.

A. West Don Lands, Toronto, Canada (TWDI, 2002)

The Toronto waterfront development has received the LEED for neighborhood development gold certificate with a total of 61 points achieved. Shown in Table 4 is a summary of the application of Toronto waterfront to the LEED points of sustainable development.

Table 4. Summary of Toronto's application of LEED

Common Categories		Application (Toronto LEED achievement)
Community layout		• smart mixed use neighborhood design • HIGH % Parks & opens spaces connected to the waterfront • 90% within ¼ mile to transit stops, 50% within ½ mile to services, 99% within ½ mile to schools
Buildings		• 60 % LEED certified buildings - 20% Affordable renting
Transportation		• Increased % multi modal transport, cycling, reduced car use
Environment	Water	• 15% reduction in water consumption due to Enwave project • New storm water collection system
	Energy	• 27% reduction in energy use • 30% energy supplied renewable sources Enwave deep water technology
	Materials	• Using recycled materials in infrastructure
	Waste	• Recycling 50% of construction waste - Waste diversion
	Ecology	• Preservation of the habitat near the water body by natural parks • Enwave technology reduces tones of CO2 emissions

B. Media City, UK (BRE Global, 2006), (BREEAM Communities, 2009)

MEDIACITY UK is the first scheme in the world to become a BREEAM approved sustainable community. The project achieved a Score of 76%: Potential Final Certificate Excellent.

Table 5 below is a summary of the application of Media city waterfront to the BREEAM points of sustainable development.

Table 5. Summary of Media city application of BREEAM

Common Categories		Application (BREEAM achievement)
Community layout		• Mixed use compact development • Decreased % of industrial sites & increased % of commercial & residential to 96% • Radial planning centered towards waterfront • One Huge open space on the waterfront
Buildings		• 80% BREEAM certified buildings
Transportation		• Using canal in water transportation • Increased % of multi modal transport • Encouraging cycling through providing special lanes
Environment	Water	• Water resources management • Use of water from the canal to create a combined heat & power plant energy system (Tri Gen plant)
	Energy	• Tri Gen plant as a renewable source of energy
	Materials	• 80% of construction timber environmentally friendly
	Waste	• New waste management plan for waste collection and recycling • Production of fuel from waste & using it in a power plant on site
	Ecology	• Reduce air pollution by the tri gen plant & the increased use of public transport • Major Brownfield urban regeneration

C. Mina Zayed Community, Abu Dhabi, UAE (Abu Dhabi Urban Planning Council,2010)

Mina Zayed is a new community mixed use project development on the waterfront of Abu Dhabi developed by ALDAR corporation. Mina Zayed's ambition is to create an integrated and sustainable new waterfront community that affords a vibrant example for the future development of Abu Dhabi. Table 6 below incorporates many practices for achieving Estidama.

Table 6. Summary of Abu Dhabi application of Pearl

Common Categories		Application (pearl achievement)
Community layout		• Mixed use compact development • 20% open spaces & parks on the waterfront • continuous shaded pedestrian routes that link the center to it's waterfront.
Buildings		• 99% PEARL certified buildings • Housing variety
Transportation		• Multiple transportation options and transit supportive practicesto reduce car use • Street management between car lanes, rails & walking lanes
Environment	Water	• Low water use landscape • Utilize biological water treatment systems with least energy consumption
	Energy	• District cooling strategy • Green roofs & compact development for shading & cooling
	Materials	• Use of local materials, reuse and recycle materials
	Waste	• waste management plan • recycle a large % of the demolition of industrial site
	Ecology	• Conserving the shoreline • Re-introducing nature on a formerindustrial site • High % of parks reinforce the natural systems and help in habitat creation

The analysis of the three previous examples and their implementation of the different rating systems prove that all the previous rating systems are concerned with the environmental factor of sustainability more than the social and economic factors (Given that Environmental, Social and Economic are the 3 pillars of sustainability(WCED, 1987).

Another conclusion is that all the rating systems when dealing with a waterfront community include rating categories like waterfront (water body or wetland) conservation either from pollution or from habitat extinction which are environmental aspects, but there are no rating categories for integration with the waterfront ; the social and economic aspects (other 2 pillars of sustainability) for example, specifying the percentage of open spaces which must be on the waterfron or the type of land use on the waterfront, or the percentage of recreational facilities which must be on the waterfront as all these principles increase the social and physical interaction between people and the waterfront as well as the economic values pointed by the principles in section 2.

Although these indicators were not required in the rating systems, the examples succeeded in applying some of them to integrate with the waterfront, which means that integration with the waterfront is an important feature for sustainable planning and must be considered under any rating system when dealing with a waterfront. So, a set of new indicators concerning waterfront development, including environmental, social and economic aspects of sustainability along with the categories discussed before will be taken to form a rating system to be implemented on the case study of Abu Qir area.

Integration with the waterfront, a comparison		Principles of sustainable waterfronts:
Toronto	•Reduce water consumption from the river •Benefit from water by Enwave water technology	1 - Secure the quality of water and the environment
Media city	•planning order is almost radial (centered towards the waterfront) •Huge open space on the waterfront	2 - Waterfronts are part of the existing urban fabric
		3 - The historic identity gives character
		4 - Mixed use is a priority
		5 - Public access is a prerequisite
Mina Zayed	•Preventing pollution of the water by removing former industrial land •20% of the project's total area is dedicated for open spaces, parks and green areas, most of these spaces are on the waterfront interconnected to each other by the green lanes	6 - Public participation is an element of sustainability
		7 - Planning in public private partnerships speeds the process
		8 - Waterfronts are long term projects
		9 - Waterfronts profit from international networking
		10 - Re-vitalization is an ongoing process

A set of Indicators « Integration With The Waterfront »

Degree of Integration with the water body
Degree of benefiting from the water source
Sea Level Rise management using network of streets and parks
% Open spaces on the waterfront
Land use adjacent to or on the waterfront
% Recreational facilities on the waterfront
Linked facilities and open spaces on the waterfront

Common Categories	
Community layout	
Buildings	
Transportation	
Environment	Water
	Energy
	Materials
	Waste
	Ecology
Innovation	
Integration with the waterfront	

Fig .1. Conclusion, addition of a new category « Integration With The Waterfront » & the indicators under it

V. ANALYTICAL REVIEW OF ALEXANDRIA'S WATERFRONT (ABU QIR AS A CASE STUDY)

Abu Qir area analysis includes a study of it's physical, environmental and historical features. In the following subsections, the problems of the area are concluded and organized in terms of priority, under the five categories of the framework.This helps in determining what the biggest problem of the area is like, which must be considered first. Afterwards, the other potential problems should be considered prior to the urban development of the area as well. The study is based on a document review of the future comprehensive planning for the development strategy of Abu Qir area, including site visits, observtions, interviews, together with consulting experts of urban planning, coastal planning and environmental design.

A. Abu Qir Review

Alexandria city is the second largest city in Egypt, either in terms of population or economical growth. Located on the Mediterranean sea with a length of 93.5 km on the waterfront from Abu Qir bay on the east up to Matrouh city on the west. Abu Qir (shown in Fig.2) is one of the communities of Montazah District in Alexandria city with an area of 60 km2 from the total area of the Montazah district which is 81 km2 (Alexandria Governorate, 1984). Abu Qir with a population range of 200,000 residents consists of 3 neighborhoods which are Abu Qir, Toson, and Mamoura Elbalad. It represents one of the most important historical places in Egypt (Alexandria

comprehensive plan 2017).

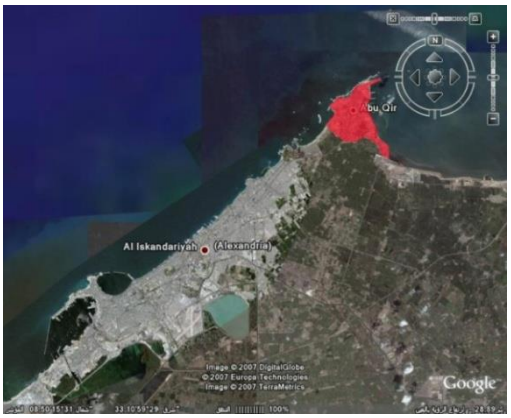

Fig .2. Location of Abu Qir
Source: Google maps, accessed June 2011

B. Motives for Replanning

- It is a strategic location as it is considered an eastern gate to Alexandria.
- There are a lot of motives for development: a waterfront with many brownfields, unplanned open spaces, historical sites and sunken treasures (Goddio, 2007; Encyclopaedia of the orient, May 2011)
- It has three important historical fortresses: El-Sabaa, Tawfeekeya and El-Raml fortresses, which could form an important historical tour in Alexandria as they represent an important era in the history of Egypt. Unfortunately, they strongly need a great work of rehabilitation and renovation.
- Abu Qir bay (lying on a Dead Sea area) is considered a fertile marine habitat when compared with other Egyptian Mediterranean coastal waters (ASRT, 1984; Hamouda & Abdelsalam, 2010).
- Abu Qir bay can be used for a variety of purposes: commercial and recreational fishing, shipping, recreational boating, yachting, swimming and diving to explore sunken monuments.
- Abu Qir is famous for its warm temperature and warm seawater which facilitate the development of a lot of recreational beaches and touristic facilities on the waterfront which can enhance and promote the economic development of the area.

C. Site Analysis:

In the map below having a master plan for the city, we can observe from the land use, accessibility and building conditions analysis that martial sites occupy a large area of the waterfront which act as a barrier between central Abu Qir and the waterfront. As a result, scattered parts of groups of buildings are left in the center. Another barrier is the train line which seperates west Abu Qir from east Abu Qir.

Fig .3. Map showing the Master plan, street layout in Abu Qir
Source: the researcher

D. Problems of the Site

After analyzing the context of Abu Qir area as a whole, its natural, historical, economic and touristic features along with its land use, accessibility and building conditions, the following problems are concluded as follows.

- Problems Related to Community Layout and Integration with the Waterfront

Abu Qir area is not well connected to it's waterfront due to the following :

1- The absence of pedestrian accessible streets leading to the waterfront (either very narrow streets between slums which are the residential areas on the waterfront, or inaccessible streets inside military sites on the waterfront).

2- Inefficient street layouts which lead to the presence of only one main street as an entrance to Abu Qir and Touson areas after Mamoura neighborhood (Gabr, 2009)

3- The absence of connected open spaces on the waterfront.stable till it reaches the outlet.

Fig .4. Presence of a lot of high illegal buildings on the waterfront

4- The absence of well developed attractive beaches or recreational facilities on the waterfront

5- The absence of usable (opened) marines which can connect the area altogether if water transport is present.

6- The presence of military sites in separated zones on the waterfront which cut the way between Abu Qir downtown and the waterfront.

Fig .5. presence of martial sites in separated zones

7- The land use in Abu Qir area is either residential or industrial, plus the martial sites which occupy large areas in Abu Qir region (no mixed land use).

8- The presence of unplanned areas and scattered slums.

9- The presence of a lot of agricultural or space lands which separate Abu Qir urban zone from the rest of Alexandria.

10- The calculations of population density in Abu Qir community, made by Alexandria governorate have proven that there is a continuous growth in population density in Abu Qir area without a balance in job opportunities, facilities, housing and infrastructure (Alexandria comprehensive plan for 2017, 1997)

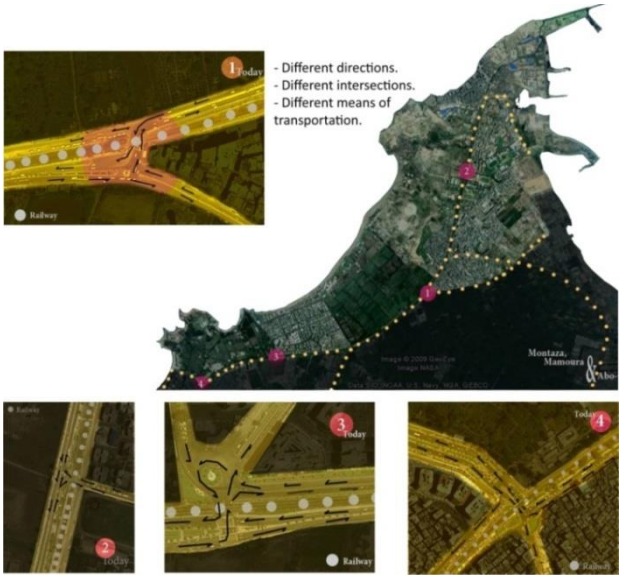

Fig .6. Trafic Problems in Abu Qir
Source : Researcher

- Problems Related to Transportation

1- Growth in population with insufficient public transportation leads to increasing reliance on private cars and buses

2- Occurence of continuous traffic jam due to increasing number of cars.

3- Occurence of traffic problems and accidents due to unplanned intersections and the absence of stop signs.

4- Number of trains reaching Abu Qir train station is not big enough to meet the need targeted as it is the only means of transportation for most workers in Abu Qir area. Moreover, trains and train lines are too old, dirty and don't work with full power (Gabr, 2009)

5- Train lines occupy large space of the street width increasing traffic conjestion. They also form a barrier between west and east of Abu Qir as they are closed with a high wall barrier.

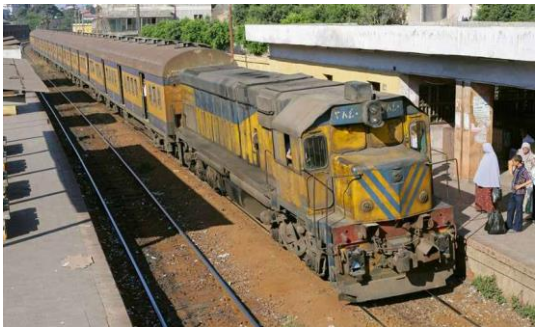

Fig .7. The problems of transport in Abu Qir source : researcher

- Problems Related to Transportation

1- Illegal high buildings on the waterfront of Abu Qir (Alexandria governorate, 1997)

2- The Presence of slums and narrow streets, with deteriorated buildings scattered here and there makes it impossible to supply such places with efficient infrastructure needed (waste, water supply, electricity, gas, sewage grid, telephone lines …. etc)

3- The presence of illegal fast construction projects everywhere, streching out to the sea shore leads to the sloping down of buildings and in some cases collapsing. They also lead to the emergence of unplanned streets and narrow corridors. These illegal buildings never comply with the architectural character of theplace.

Fig .8. The problems of buildings in Abu Qir Source: http://www.flickr.com/photos/david_vilder

- Problems Related to Waste

1- The presence of a lot of areas with no supply of drainage pipes leading to draining in wells. These wells cannot be reached by maintainace cars because the streets are very narrow, consequently a blockage of these wells occurs leading to sanitary problems.

2- Water pollution of Abu Qir bay due to untreated sewage and industrial waste discharged from different sources like El-Tabia pumping station. This station discharges polluted industrial waste from factories of food processing, canning, paper, fertilizers and textiles. The outlet of Idku Lake which contains drainage water from agriculture, usually containing pesticides, is another source of pollution. Added to this is the Rosetta mouth of the Nile River which discharges fresh water carring agricultural waste from cultivated lands. (Nasr, et al., 2003)

3- No waste collection which leads to accumulation of waste in front of buildings and houses.

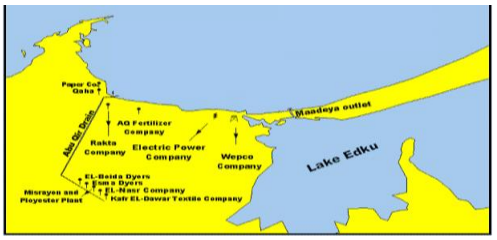

Fig .9. The study area where the arrows indicate the sources of pollution along Abu-Qir Bay Source: the researcher

Fig .10. The problems of waste in Abu Qir Source: http://www.flickr.com/photos/david_vilder

- Problems Related to Water

  1- Infrastructure problem related to sewage grid, leading to insufficient number of sewers that cause water blockage in the streets during rainy days of the year. (Alexandria governorate comprehensive plan for 2017)

  2- No water supply in many areas (particularly slums) which drives many citizens to practice unlawful activities to have water supply connections.

- Problems Related to Environment

  1- Air pollution from different industrial factories in Abu Qir (Kamel, 2002)

  2- Water pollution in the eastern area of Abu Qir bay (Dead sea) from ships and marine waste (Gabr, 2009)

  3- The problem of climate change is being taken seriously by the Egyptian authorities. The low lying land in the Nile Delta region is considered to be at risk due to the potential effects of any sea level rise resulting from global warming. In particular, the cities of Alexandria, Rosetta and Port Said, which are major industrial and economic centres, are expected to experience serious environmental impacts, if no action is taken (El-Raey, 2009).Therefore, as long as Abu Qir region represents a large area of the coast of Alexandria, it is considered to be at a high risk of submerging.

- Problems Related to Energy

  1- The absence of any means of energy saving in buildings or in the community as a whole due to all the previous problems.

  2- Although Abu Qir area in particular (and Alexandria in general) is one of the most sunny places in the world, still there is no benefit from the sun as a renewable source of energy.

E. Conclusion

Referring to the previous problems, the document review of the future comprehensive planning for development strategy of Abu Qir area, the site visits, the interviews, plus the consulting experts in urban and coastal planning as well as environmental design, it is concluded that most of the problems which are present in Abu Qir area are problems related to community planning and integration with the waterfront. Moreover, the other problems of transportation, buildings and environment are all due to the unplanned community of Abu Qir, and can be solved if community planning and integration with the waterfront are maintained. As a result, community layout and integration with the waterfront should have the highest priority (as shown in Fig.10) when considering a developmentproject. The problem of transportation, which is the second significant issue comes next. It should be solved instantly as Abu Qir area is full of workplaces and important facilities that have to be easily reached and made use of. Next to transportaion is the problem of existing buildings. Though it is not as important as transportation; still the field study and survey show that building conditions, heights and utilities constitute a major problem of concern. Then comes the environmental category that forms higher levels of sustainability. This is explained by colouring priority table from red as the highest priority to violet as the lowest one.

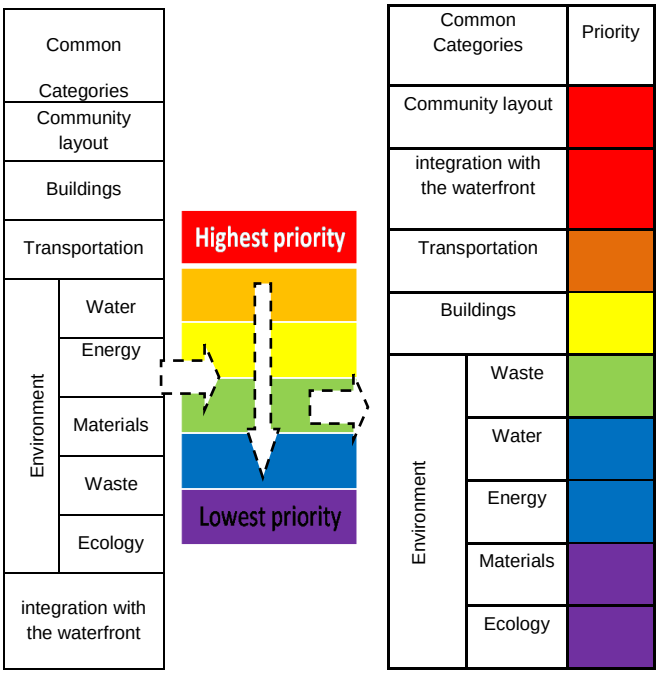

Fig .11. Defining priorities from problems of the case

F. Implementations of Sustainability Guidelines in Development of Abu Qir

Abu Qir community sustainable urban planning needs to consider all of the previous categories resulting from the problems discussed above, bearing in mind to follow the same priority order. Rrenovation and rehabilitaion works should be environmentally, socially and economically sustainable. Each indicator under those categories is chosen from one of the rating systems analyzed, The indicators chosen are only the indicators that concern the problems in Abu Qir area. In addition to the indicators specific for the waterfront (concluded in section 4), a checklist of recommended criteria should be set for the replanning of Abu Qir area.

Table 7. shows The Checklist of criteria produced for sustainable replanning of Abu Qir

Category	Indicator
Community layout	Open community
	Compact development
	Diversity of uses
	Street network
	Access to public spaces
	Universal accessibility
	Community outreach & involvement
Integration with the waterfront	Degree of Integration with the water body
	Degree of benefiting from the water source
	Open spaces on the waterfront
	Land use adjacent to or on the waterfront
	Recreational facilities on the waterfront
	Linked facilities and open spaces on the waterfront
Transport	Public transport
	Reduced automobile dependence
	Bicycle network
	Transportation demand management
	Transit facilities
	Street network
	Walkable streets
	Reduced parking footprint
	Traffic management
Buildings	Energy efficient buildings
	Construction pollution prevention
	Reuse of historic buildings
	Building reuse & adaptive reuse
	Housing & jobs proximity
	Diversity of housing types
	Affordable housing
Environment – Waste	Waste management
	Proximity to waste water infrastructure
	Construction waste management
Environment – **Water**	Water resources management
	Water consumption management
	Community water strategy
	Wet land & water body conservation
	Building water guidelines
	Water monitoring & leak detection
	Community water use reduction: Landscaping
	Community water use reduction: Heat rejection
	Community water use reduction: Water features
	Storm water management
	Water efficient buildings
	Proximity to water infrastructure
Environment – **Energy**	Energy consumption management
	Community energy strategy
	Building energy guidelines
	Energy monitoring & reporting
	Community strategies for passive cooling
	Urban heat reduction
	Renewable energy: Onsite
	Renewable energy: Offsite
	Energy efficient buildings
	Infrastructure energy efficiency
Environment – **erial**	Local materials
	Recycled materials
Environment – **Ecology**	Biodiversity
	Conservation management of habitat & wetland
	Natural systems protection
	Reuse of land
	Remediation of contaminated land
	Habitat creation & restoration
	Local food production
	Minimize site disturbance through site design
	Minimize site disturbance during construction
	Heat island reduction
	Solar orientation
	Reduce air pollution

VI. CONCLUSION

There is a need to develop a rating system specifically for the evaluation and upgrading of Abu Qir as a waterfront community. The rating system should consider the following:

- Priorities first (biggest problems are the first

to be solved).

- Creation of connections between waterfront and inner City districts.
- Benefit from the water source either physically or environmentally.
- Water as a means of transportation to reduce city traffic and improve the quality of the urban environment.
- Public accessibility to the waterfront by linking open spaces and recreational facilities to increase social and economic income.
- Utilization of unused land on the waterfront to serve the previous point.
- Revival of the waterfront with attractive uses, high-quality public spaces, and publicly oriented water-dependent uses, integrated with adjacent communities.
- Maintenance and improvement of the environmental quality of water bodies, land and air.

VII. Concluding Remarks

Waterfront sustainable development is now an obligation for all waterfront cities. However, Waterfront planning differs from one place to another according to the needs and problems of the region.That is why all rating system must have it's own weighting sustainable strategies are the same worldwide, they all call for the same principles. On the other hand, different obligations, rules and regulations are applied to them according to the needs and problems of each region. The Egyptian region (Waterfront in particular) needs its own sustainability rating system. Pursuing strategies to improve the sustainability of the city's waterfront, the government should focus on increasing resilience to climate change and projected sea-level rise. Economic interests must be balanced with environmental and social concerns. However, waterfront work is not just about economic development; yet it is not simply a design question or only about environmental issues. Rather, it is a fusion of these elements and related disciplines like Balance-People-Recreation-Public access-Open space-Safety-Suitable and Diverse Living-Mix of Uses- Environment- Transport which are all principles of sustainability.

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