The International Conference *for* Environmental Science

21-22 May 2013

Research title

Planning adaptations an executive proposal to save the threatened cities by natural disasters

(Case study of the city of Alexandria – Egypt)

M. M / Mohamed Abdel Rahman Abu Kahla
Teacher Assistant, Department of Urban Planning
College of Engineering - Al-Azhar University

Dr. Waleed Elalfy
Doctor in Urban planning
Department Faculty of Engineering
AL AZHAR University

Abstract:

Natural disasters especially the drowning of coastal cities as a result of global warming, which is the rising of seas and oceans water level as a result of the rise of earth's temperature, will affect the general plan and the urban structural plan, consequently that will affect the urban identity of the city, therefore the urban structure, social, economic identities will change.

This is in addition to the many towns and villages threatened by natural disasters as earthquakes, floods, volcanoes….etc

So the research will discuss one of the new planning solutions to deal with these cities in both current and future status, where it will be specified in following the theory of planning adaptation (planning adaptation, which is urban, social, and economic adaptation with the current position of the city during and after the disaster) as one of the solutions to face and cope with the disaster.

The methodology of the research depends on two methods theoretical and practical method, in the theoretical method the study and the definition of the natural disasters will be tackled, the concept of adaptation planning and the possibility of saving the threatened cities, also the ways of how to cope with the natural environment of this cities also bringing up some local and international examples in following the protection, adaptation policy to the cities affected by the disaster .As for the practical field, the conclusions of theoretical field will be applied on some of the threatened cities as Alexandria and the planning policy followed to cope with the disaster on the local ,urban ,economical levels or the inhabitants coping to the new conditions of the city after shrinking ,also the research will discuss some research questions connected to the study such as:

1-will following the planning adaptation for the threatened cities by re-planning will be less expensive than planning a new city away from the range of natural disasters area?
2-will the planning adaptation be the overall change to the economic policy of the city?
3-What is the role of planning adaptation with the policy of preserving the urban situation?
4- Will the urban structure of the city be changed by the planning Localization?

And from the research, the results will explain the method of preserving the coastal cities threatened by the disaster of drowning as result of global warming.

Key words
Natural disasters, planning localization, cope, global warming, urban structure of the city, sustainable development, green planning, green economy.

Research Problem

Communities and nations faces different problems as cultural ,social, political and health problems and many others from one side from the other side we find natural phenomenon disasters that societies faces it and of course facing this kind of phenomenon is different than facing the first side problems, and the reason is that most of the urban planning that is prepared in Egypt did not take into consideration facing the natural phenomenon in planning either it was Structural or regional or public plans and specially the disaster of delta drowning in Egypt and how it can be dealt with in an engineered way, where the research would deal to clarify and resolve these problems in detail.

The importance of the research

- The nineties century witnessed the birth of a new science, which is the science of dangers and disasters and it became a stable science that has its international and regional conferences its scientific role, and the concern for it starts to appear in geography section, geology, and other social sciences and all this sciences has its direct and effective impact on the urban planning and its theories.
- Also there are other sciences that is concerned with urban planning, while there is no scientific researches or practical studies or researches that connects between the urban planning and natural phenomenon, **so the research will merge between natural disasters science and how can we use it in urban planning and studies that was done in urban planning facing the disaster of delta drowning.**

Second: global and regional experiences

Some global experiences were taken that followed planning basics to face the natural disasters that affects the urban planning of the existing cities

1. **The Experience of Katrina Hurricane in 2005, which swept New Orleans City.**

new Orleans city lies on Mississippi river and on the Mexican gulf in the united states ,it is bounded by the Mississippi river from the south and Pontchartrain lake from the north ,and because its strategic position on the Mexican gulf ,new Orleans became a major port ,and takes the first rank as the largest port in united states and the forth on the world ,and its population reaches 500000 person .

And most of New Orleans City lies between 1-3 meter under sea level, and that is why they have a group of ports, flood walls, establishments, pumps and canals to keep the city dry away from the penetration of Pontchartrain lake and Mississippi river to its internal parts, which can keep part of the flood plain to the Mississippi River, Where rain water is pumped from the city to the discharge channels in Lake Pontchartrain, the existing pump system was not designed to receive flood water that may enter into New Orleans.

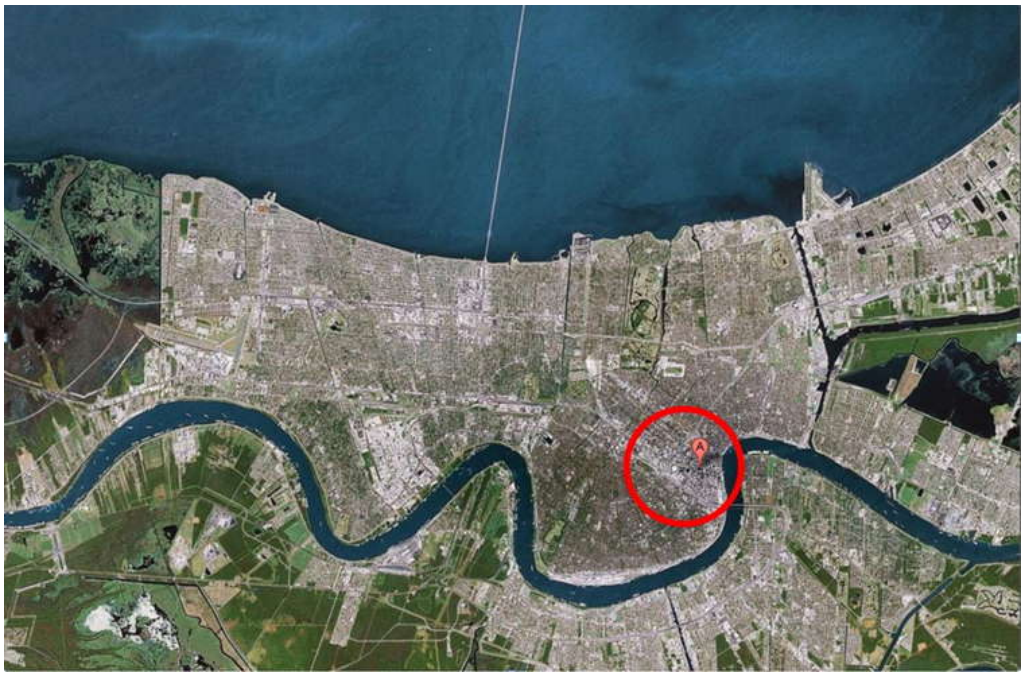

Figure (1) New Orleans location

In year 2005, Hurricane Katrina hit strongly states of Louisiana, Mississippi and Alabama (the three states in the southern United States of America), and the total

affected area was about 235 thousand km and the damages were extended with a length between 40-50 km on the shores of the state of Mississippi and the speed of the wind 285 km / h, the heavy rains that followed the hurricane resulted in rising water levels causing flooding that resulted in the drowning of 80% of the city, making it the worst natural disaster in the United States in its history, and figure (1) illustrates the location of the city of New Orleans, while figure (2) illustrates the drowning city after the hurricane Where it does not appear in the picture except the roofs and the tops of trees in the middle of the water.

Figure (2) shows the drowning of the city after Catherina hurricane -2005

The argument was raised about the worthiness of rebuilding the city that has history and great economic and cultural revenues so the following questions were raised:
1-is it easier and cheaper to build a totally new city in a place that is not subject to hurricane as this city?
2-is using the urban adaptation with the existing cities that is threatened with disasters is cheaper than the planning of a whole new city in a far place away from natural disasters ?and where is the city identity in this case

3-Is the planning adaptation is the overall change of the economic policy of the city?

The Planning Commission and the Federal Emergency formed a team of planners and visited the city in order to build their planning capacity and start practical work under a long-term plan so that local officials can make decisions concerning the development and construction.

So the decisions were taken to re-plan the existing city and developing its economical, urban structure as it enjoys a strategic location , changing the existing structure of the city by establishing ports sidewalks , dams and walls to resist floods, and hurricanes, and improving the pumps and channels that rainwater will be deflated into(1).

Where the process of reform started by dewatering that immersed the city, and started to remove the establishments and the obstacles in the city and counting of, ramshackle buildings, where the consultants and experts found out that pursuing a policy of conservation and development and maintenance of the existing city far less expensive than building a new city in a safe place ,this is the from the economic aspect , but with following adaptation theory that had a strong impact on maintaining the character and texture of the old city (economic commercial heart of the city).

2-Venice Experience in the North of Italy

Venice city is a city in the north of Italy The capital of the Veneto region and the Province of Venice, its estimated population is 332 thousand inhabitants and its area is 41200 hectares, the city consists of several islands connected to each other by bridges, the city overlooks the Adriatic Sea, just 4 km away from the Italian coast.

By studying the historical insight of the city it was an ancient urban gatherings on several islands until the year 1966, the devastating flood (River Arno flood), which hit most of Italy causing great destruction in general and to the city of Venice in particular, where the floods caused serious damages and destroyed much of historical and cultural urban heritage of the city and its islands.

---

[1] [illegible]

Figure (3) location of Venice city in Italy

To follow the policy of maintaining the city and its architectural heritage the theory of planning adaptation was followed , instead of leaving the city devastated due to high water levels as it used to sink by a rate of 5 mm per year starting of its sinking time and till the seventies of the twentieth century, until it reached its present situation where water was raised from 1 m to3 m in some islands, and therefore what happened was made use of and was adapted to it.

Therefore, the city become one of the most important Italian cities and the most beautiful cities in Italy because of its historic buildings that was preserved and maintained and strengthened, where it goes back to the Renaissance age in Italy with its different water channels that makes it unique in the whole world, the city of Venice is divided to 6 provinces (Bellino, Padua and Rovigo and Venice, Verona, Vicenza), the city is considered one of the most important commercial and touristic ports in Europe during the Crusades and have an ancient and recent huge force.

Figure (4The Buildings Height in the historical building after reinforcing it and filling half of it underground

Form (5) The Possibility of Horizontal Consolidation of Heritage Buildings

Transportations in Venice

Boats and water transportation is considered the most widely spread way of transportation in the city were Venice city is considered one of the most difficult places in mobility practically and ergonomically as it contains more than attached island so the only way of movement in the city is limited to classic boats widely available in the city that is called gondola and in the nineteen century The city has been provided with a railway station which is located outside the main city center. In the twentieth century a main street was constructed that connects the city with its neighbors, and public stations. Therefore the city is ideal in terms of not using of cars and trucks on the level of Europe and the world. And also to the city can be reached by air with a newly built airport to serve the city and the surrounding suburbs, and it is called Marco Polo International Airport.

Figure (6) shows the transportations in the city and the relation of the human's height with the immersed area

Adaptation policy that was followed to protect the city

1. Italian government limited the use of ground wells in the city which increased the pressure of water under the island, which in turn led to a stop of sinking of the city. (Urban adaptation)

2. Buildings are not based on solid grounds, but on the pillars that lay in the mud to strengthen the existing buildings where there are no place to build new housing. (Urban adaptation**)**

Figure (7) different strengthening methods to the valuable buildings

Figure (8) Other Methods of strengthening (vertical strengthening)

3. tourism is considered the main economic activity in the city, where about 3 million tourist visits the historic center of the city each year, and represents an important purchasing power for handmade production made by the city's inhabitants, also the industrial and commercial activities is concentrated in Meester and majeera area , where the presence of factories and workshops that have been preserved (follow the preservation policy), as port facilities are concentrated in majeera , the industrial development in the Italian mainland city offered thousands of jobs for residents also that industrial development was a major cause of air and water pollution that threatens the city. (economic adaptation)

4. International, governmental and civil organizations and individuals volunteered with money and other assistance to repair and restore work. (Social adaptation)

5. After the flood some government committees, as well as independent researchers made some studies to access a methods to control water levels and to preserve the city

and its historical urban and cultural identity, and reduce the environmental, visual and urban pollution, of the city. (Urban and economic adaptation)

6- At the late eighties of the twenties century the government paid a sum of money to support projects designed to protect the city from floods and maintain its cultural organization and from the corrosion caused by sea erosion (urban, social, economic adaptation)

Figure (9) Ground Floor and its closeness to sea level after the city drowns

Figure (10) The flooded distance in some areas and it is clear that it doesn't exceed 50cm

Urban problems to the city of Venice

- permanent exposure to water weakens the bases of the city
- air pollution and the relative increase in humidity works on the corrosion of buildings and a lot of the artistic treasures in the city
- water overflows in winter immersing public squares ,roads and destroying buildings

all this problems can be avoided with permanent maintenance and follow up which is happening to preserve the historical and cultural value of the city

3-german and Holland experiences

Both Germany and Netherlands did not deal oppositely with the environmental directions of the nature of these cities, especially old historical districts in the heart of the existing cities

But they dealt with the environment inherently, When the underground water rise or it heavily rains or water level rises that will lead to the sinking of all the ancient cities, so Urban adaptation was done with these phenomena using moving dams so that they are opened to reduce water access to the historical center of the city as shown in the illustrated figures and after the reduction of water levels these dams automatically falls inside the earth

Figure (11) The Location of the Iron Fence when it is Closed

Figure (12) the iron fence when it is being used as a barrier against water reaching historical places

Figure 13 before closing the retaining walls

Figure (14) after closing the retaining walls as a policy for protection against the danger of nature

4- The Experience of Masdr City – Abu Dabi

This experience is not as the rest of previous experiences as it is not an ancient city or with a special urban style but it is a new city that can be used as guide in historical areas or neighboring areas to reduce global warming and environmental pollution that has a direct effect on the physical character of the valuable architectural building and therefore Abu Dhabi is establishing now Masdar City, the first city in the world free from any carbon emission causing global warming since February 2008, which returns to the emirates after that, with the tenth of oil reserves . And the city of "masder " use fully renewable energies, including solar energy that can be generated out of the desert climate in Abu Dhabi, and will live in the city, 50 thousand people will use programmed daily transportation that works electronically , as the city will provide at the same time to its residents a better life environment . "And at the end of construction work for the city in 2013 its residents will be able to move by moving tram robot and other eco-friendly means throughout its suburbs, as other means of transportation are the horizontal elevators that its user determines his destination and it directly take them(2)

- منتدى البيئة،(نشرة غير دورية تصدرها الشبكة العربية للبيئة والتنمية)، القاهرة العدد ١٩٩ أكتوبر ٢٠٠٨.

Planning results for international and global experiences

1 - Due to the importance of the cultural and the physical and social dimension on the urban nature to the historical cities, so the following of planning adaptation to protect this wealth as a result of natural disasters is less expensive than destroying and removing it and building of new cities in a relatively safe place of that disasters.

2 - The importance of the city's identity and its urban fabric and architectural character all this has importance when using the theory of adaptation.

3 - Following the planning adaptation a total change in the economic policy of the city does not happen, but you can modify some of these policies to fit the current situation after the disaster, and likewise an overall change in the Urban Structure of the historical Cities never happens, but it have some amendments in accordance with the current status of the city.

Third: Applied Framework

Overview about Alexandria City (Case Study)

History of Alexandria and its rank in the global heritage

Alexandria, named as the bride of the Mediterranean, which is the second largest city in Egypt after Cairo, and is considered the second capital of Egypt and the ancient capital of it , it lies along the Mediterranean coast, with a length of about 70 km north-west of the Nile Delta, and bounded on the north by the Mediterranean sea , and Mariot lake from the south till 71 km on the Cairo-Alexandria Desert road, and is bordered to the east by Abu Qir Bay and the city of Edco, and on the west the region of Sidi Krier till 36.30 km on the way Alexandria - Matrouh.

The effect of drowning the delta on Alexandria city

With the Rise of sea level at the global level, many areas in Alexandria is threatened with drowning and specially old areas of the city, where the immersed monuments of the Greek and Romanian in the eastern harbor and Abu Qir Bay, that goes back to around 500 BC, is now lying at a depth between two meters and 5.5 meters below the sea surface.

It was found by geomorphologic analysis to monuments sites on land, such as Shaatibi cemeteries , Mustafa Kamel, Anfoushi, com Alshkaka , Tigran street , along with the location of com Deka , which includes the Roman theater that these sites are very close to each other and extending in the depths of the earth for long distances making Mnasebha the undersea level, as is the case in a cemetery Ketakomb Kom cemetery in kom alshkaka , as well as areas under rising sea levels by a meter , it contains a wealth represented by the submerged monuments in shallow waters along the shores of the northern cities, as is the case in Abu Qir Bay and the ancient eastern port in Alexandria, the following maps have been prepared by an analytical process that combines between rising sea levels and areas of distinguished urban character , in Alexandria by a program ARC GIS and as shown in the following pictures taken with satellite to (Abu Qir - Customs) in case of rising water to 1 m - 2 m - 3 m, as mentioned in some IPCC reports over the next fifty years.

Figure (15) Sinking Historical Areas in El-Gomrok district when the water level rises to 1m

Figure (16) Sinking Historical Areas in El-Gomrok district when the water level rises to 2m

Figure (17) Sinking Historical Areas in El-Gomrok district when the water level rises to 3m

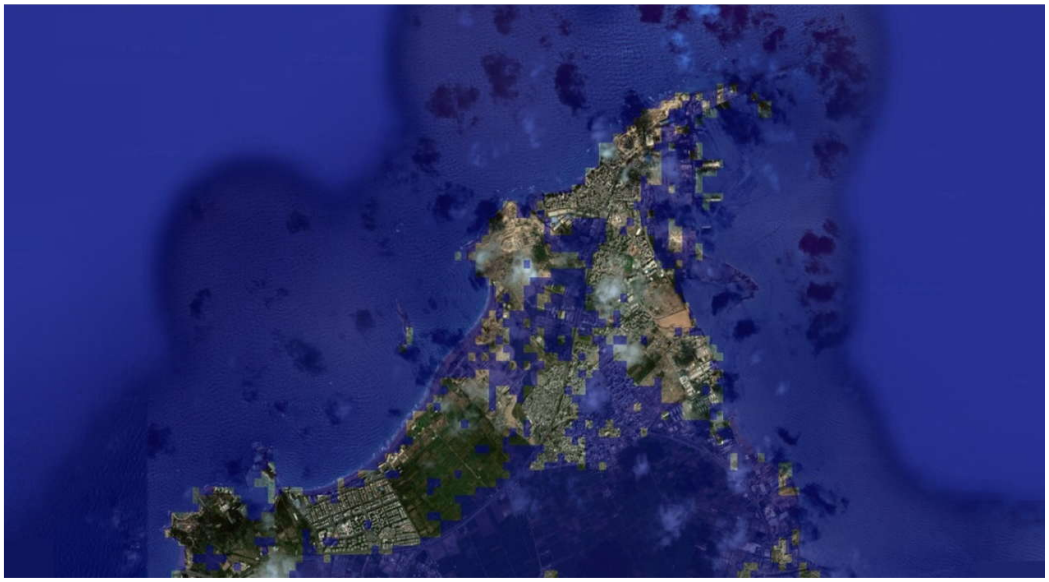

Figure (18) Sinking Historical Areas in Abu kier district when the water level rises to 1m

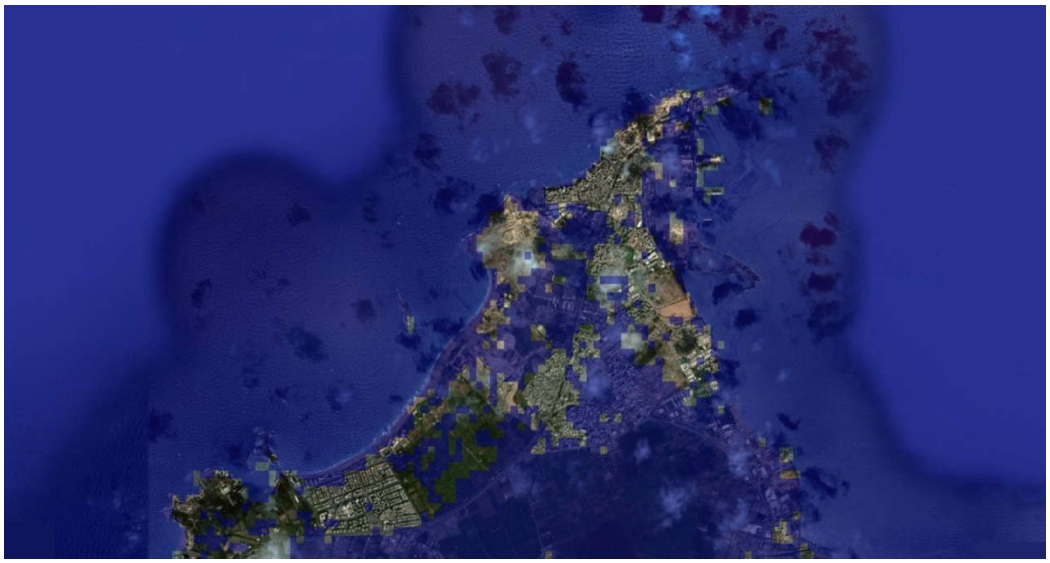

Figure (19) Sinking Historical Areas in Abu kier district when the water level rises to 2m

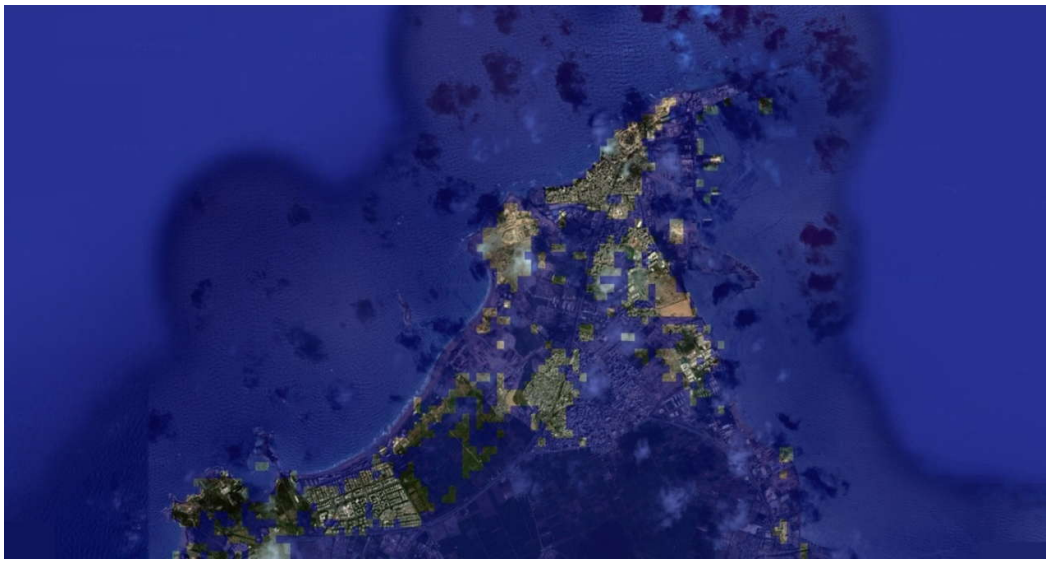

Figure (20) Sinking Historical Areas in Abu kier district when the water level rises to 3m

Following a policy of planning adaptation as an executive proposal to face the disaster, of sinking of the Delta and coastal cities as a result of global warming

As a result of what was previously discussed in the research about global warming and the drowning of parts of Delta Egypt, we find out that the removal of existing cities on the coasts and in particular the city of Alexandria (case study) and relocation is difficult, if not impossible due to its historical ,cultural, social and economic value ,as it is a home to hundreds of thousands and some millions of people who have been associated with it ,

Through analytical study in this research and the results of both international experiences and Al Gore movie , some planning policies was raised that is being followed to support the idea of adaptation planning: -

- Stop the growth of cities along the coastline and directing it in other directions towards the safe direction of growth towards the south and west, away from the north coast.
- Adopt consecutive strategies for the growth of cities, to end up with safely growth of the city away from the coast and protect the surrounding agricultural land, which is the main economic source for the region.

In the case of the development of new cities near coastal areas must be taken into consideration when selecting sites for these cities the following recommendations:

- selection of sites that is higher than sea level (more than 3-5 meters above sea level) so as not to be affected by the phenomenon
- The locations of these cities should be relatively far from the beaches and coasts so that they are relatively safe.

In order to reduce the strength of the effect of the wave, artificial and natural wave breakers should be made.

- As For the tourist communities that arise on the coast, the waterfront must be minimized and take the village to the depth far from the coast also to take the marine water bodies within these communities. (Bring the sea to the guests).
- Coordination of tourist sites through the establishment of wave breakers to be the natural elements of and aesthetic elements.
- Planting trees, gardens and green spaces and the use of green color on the road network.
- Empty some squares and work spaces and green spaces for human movement within the urban space of the city.

[1] - رمضان الطاهر أبو ألقاسم، بشير رمضان الزليطني، جامعة الفاتح، طرابلس، ليبيا، (الاعتبارات التخطيطية لمواجهة الكوارث – حالة دراسية تخطيط إقليم الخليج بليبيا) ، ندوة إدارة الكوارث وسلامة المباني في الدول العربية, الرياض, السعودية, ٢٠٠٨م.

- When planning new cities and urban communities planning must create green open areas and not to deform the gardens with closing it by iron fence so as it will not to become as green prisons hard to use and enjoy(4)

The Followed Planning Adaptation

1 - **Urban adaptation**

1 - Construction of dams or bridges around areas with outstanding urban character can be locked or opened if necessary to the areas that are relatively not affected by drowning (Germany and the Netherlands experiences).

2 – Till now, and before the year 2050 before the disaster happens to the areas that will be immersed by water the disaster has to be stopped..... By supporting the ground floor in all buildings in distinguished areas, so as the historical area would be prepared to become a global tourist city on the European-style to rival the city of Venice, Venice Province (Italian experience in the city of Venice).

3 - building bridges and drafts made of cement on weak areas on the coast with certain heights where there are about 75 km of coastline weak and must be strengthened at the level of the Delta as a whole, but most of the areas that must be strengthened are in the areas of Brolos on a distance of 13.5 km and Abu Qir area with a distance of 9 km with the presence of a draft of 4 meters including a meter and a half above sea level.

4 - Modify the uses of agricultural land and combinations that fit with the new climate conditions to face the global warming.

2 - **Economic adaptation**

1 **- General Economic Adaptation**

It is the adaptation with the new situation of the population, under a condition to change the economic base of the city, for example, changing from the agricultural activity to fishing or tourism, or industry or trade activities. (Italy's experience at Venice city)

2 **- Agricultural activity around the city of Alexandria**

- The development of new varieties that can tolerate high temperature, salinity and drought which are the conditions that will be prevalent under conditions of climate change.
- Develop new varieties short growing season to reduce the necessary water requirements

---

[1]. - إسماعيل عبد العزيز عامر, كلية الهندسة,جامعة الأزهر، القاهرة، بحث السجون الخضراء، مؤتمر الأزهر الهندسي الدولي العاشر, ٢٠٠٨م.

- Changing planting dates to suit the new weather conditions, as well as the cultivation of suitable crops in suitable climate zones to increasing the crop yield per unit of water for each crop.
- reduce the area of consuming crops that waste water or at least not increase the space decided to them (such as rice and sugar cane), and plant alternative crops that covers the same purpose and its water consumption and growing season is less (such as the cultivation of sugar beet rather than cane sugar).

3 - **Social Adaptation**

1. Human resources development, and explaining to them the planned outline of urban areas after the year 2050 and thus explain the economic base and the proposed situation after the disaster happens.
2. Popular participation for all society and community members to follow the policy of maintaining areas with distinctive architectural value.
3. Create educational status for the affected communities affected by the disaster.

4 - **Environmental adaptation**

- Preserve agricultural land and activate the green belt around the city and the presence of green spaces within the city and not to fill up the rivers, lakes and waterways all that plays a role in balancing the urban environment between the areas of housing, employment and industry (the preservation of biological life and construction on the ground).

---

٥ – سامية المرصفاوي، مقالة بمجلة ما بعد، العدد الثالث،٢٠٠٥م

Recommendations

1-the distinctive architectural areas should be protected against natural disasters and keeping it and maintain it as it is considered a history and culture to any city and not to displace its residents and leave it to face the natural disasters ,not only this but also losing a land that costs trillions of dollars

2-urban planning to any city depends on urban organization that consists of three elements (economy –social –environment)in order to protect the urban places with high value the urban policy should be followed and take the three pivots side by side and not to leave any of them.

3-in order to make the theory of adaptation planning succeed the economical, social, environmental, population development should be followed to make the success of urban development represented in the preservation policy

4-coping and adaptation with distinctive areas after being destroyed as a result of natural disasters is not an easy thing but should be warned against in media and cultural and educational institutes and to establish the idea of adaptation with compulsory circumstances that may occur in this distinctive areas

5- Both **the Ministry of Housing and the General Organization for Physical planning** should adjust the Administrative structure of the GOPP to include a sector for natural disasters and its impact on urban structures.

6- There should be coordination between the administrative authorities in the country, particularly in the following sectors

- General organization for Urban Planning.

- Management institute for crises and disasters.

- A civilized coordination institute.

- Fund for development of slums.

- National Assembly to maintain the architectural heritage.

Aimed at unifying vision and proposed mechanisms for achieving this vision will not be done until holding of seminars and conferences periodically.

7 - The government must take the consequences of natural disasters into account and attach it to urban planning and not to separate them, which gives extra attention to both of them with each other.