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## Planning for Climate Change, Why does it matter?

(From phenomenon to Integrative Action Plan)

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### Abstract

Climate change was appeared as a phenomenon since the early 19<sup>th</sup> Century, and since then non serious international commitment was conducted to reduce its rapid impacts, however after 1980<sup>th</sup> many countries made extreme efforts to document and understand climate change complex impacts and how to deal with it, but those efforts marked by successes and failures within a very uneven pace. Nowadays many (developed) countries adopted the idea of planning the city for climate change (In spite of inherent limitations to predictive capacity and uncertainty) that guarantee providing the city not only with the necessary Actions and precautions that insure the city resiliency and inhabitants' safety, but also contribute to quality of life to have liveable cities.

However, many of developing countries have another point of view in considering this issue, as they don't take climate change issue into consideration while planning for its local/national development Agenda, despite most of them are expose to natural disasters/Hazards (such as tsunamis, floods, flash floods or excessive increase in temperature), depending on the Reaction strategy and short-term Adaptation plans to confront such disasters or at least minimize their impacts. As they believe that even if they accept to conduct climate change action plan; it may represent extreme financial burden on its Local/National budget or it may affect the NGOs/international fund for development.

This paper aims to reveal this conflict by explain the climate change paradigm and how/why it transformed from just a phenomenon to Action plan. Followed by identifying the climate change planning cycle and how to make climate change action plan and the challenges that the developing countries faces in planning for climate change and how we could support their initiatives.

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## Introduction

Climate change was appeared as a phenomenon since the early 19th Century, and since then non serious international commitment was conducted to reduce its rapid impacts, however after 1980th many countries made extreme efforts to document and understand climate change complex interactions, changing likelihoods of diverse impacts and also how to deal with it, but those efforts marked by successes and failures within a very uneven pace. Nowadays many (developed) countries adopted the idea of planning the city for climate change (In spite of inherent limitations to predictive capacity and uncertainty) that guarantee providing the city not only with the necessary Actions (adaptation, mitigation) and precautions that insure the city resiliency and inhabitants' safety, but also contribute to quality of life to have liveable cities.

However, Many of developing countries have another point of view in considering this issue, as they don't take climate change issue into consideration while planning for its local/national development Agenda, despite most of them are expose to natural disasters/Hazards (such as tsunamis, floods, flash floods or excessive increase in temperature), depending on the Reaction strategy and short-term Adaptation plans to confront such disasters or at least minimize their impacts. As they believe that even if they accept to conduct climate change action plan; it may represent extreme financial burden on its Local/National budget or it may affect the NGOs/international fund for development.

This paper aims to reveal this conflict by explain the climate change paradigm and how/why it transformed from just a phenomenon to Action plan. Followed by identifying the climate change planning cycle and how this action plan can be submitted to the local/national government with integrative/clear/prioritize objectives, concerning not only climate change issue but also linked with city development Agenda. Using different decision support and assessment tools (multi criteria Assessment, simulation model within game mode) that can be used to emphasize the action plan results.

**The Aim of this Paper is** Explaining the ways of how cities can mitigate their exposure to climate change and adapt to its impacts. And the following provides a brief description of the main research questions and sections that this paper intends to discuss:

### Section 01

(Understanding and addressing the climate change impacts in cities).

- What is the climate change?
- Why does it matter to our cities?
- Why some places are more vulnerable to risks than others?

### Section 02

- Understanding the resiliency of cities.

### Section 03

(Planning for Climate Change)

- How to deal with climate change?
- How to plan for climate change Action plan?
- How to make the Actions for reducing the climate change impacts? And how to make the prioritizing for the Actions in each phase in this plan?
- What are the main challenges that the developing countries faces in its way for planning for climate change?

### Section 04

- Conclusions and Discussions

## 1. Understanding and Addressing the Climate Change Impacts in Cities.

### 1.1. What is the Climate change?

The United Nations Framework Convention on Climate Change (UNFCCC 2005), defines climate change as a “Change of Climate that is attributed directly or indirectly to human activity that alters the composition of global atmosphere and that is in-addition to nature climate variability observed over comparable time periods”. It is also what we experience when the climatic conditions permanently shift either upwards or downwards of the average. Climate change is not always a shift in the mean climate conditions, but also exhibit itself as a change in the intensity and frequency of extreme climate events, such as drought, floods, storms and strong winds among others. And that persists for an extended period, typically decades or longer.

The key climate change indicator that scientists look to is the average surface temperature<sup>2</sup> of the earth. The changes in temperature and precipitation are leading to increased storm severity and extent, extended drought conditions, sea level rise and associated coastal erosion and flooding, and increased or intensified flash flooding, among other biophysical effects. Of course, warming and related changes will vary from region to region around the globe. These changes to the earth’s weather system will impact human settlements throughout the world, with particularly severe impacts in low – and middle-income countries where the capacity to manage impacts may be limited and vulnerable populations are larger. Moreover we must mention that both human-made and natural factors contribute to climate change.

The history of the planet has been characterized by frequent changes in climate. During the 20th century, the average global temperature increased by 0.6°C. The Intergovernmental Panel on Climate Change states in its Third Assessment Report that “The Earth’s climate system has demonstrably changed on both global and regional scales since the pre-industrial era, with some of these changes attributable to human activities” (IPCC 2001). Those Human activities have led to the increase of atmospheric concentrations of greenhouse gases and changes in land use, inducing an increase of global average atmospheric temperatures. Moreover many key indicators used in different scientific literature to describe Climate Change among which: greenhouse gas composition (in particular CO<sub>2</sub>), surface temperature, precipitation (rain, snow, hail), snow cover, sea and river ice, glaciers, sea level, climate variability, extreme weather events.

The main expected **consequences of increasing atmospheric temperatures**, are as follows (IPCC 2001):

- Change of precipitation patterns.
- Change of the frequency, intensity and seasonality of extreme events such as droughts, fires, heavy precipitations, floods, storms, tropical cyclones.
- Rise in global sea level of 0.09 to 0.88 m by 2100, with serious implications for low-lying coastal areas and islands.
- Increase of carbon dioxide levels in the atmosphere and dissolved in the oceans causing increased marine acidification.

And to limit the amplitude of Climate Change, mitigation (reducing the emission and enhancing the sinks of greenhouse gases) is needed, but also adaptation strategies are necessary as well at all scales to complement Climate Change mitigation efforts.

### 1.2. Why does it matter to our cities? (Understanding climate change impact on cities).

Cities are concentrated centers of population and economic activities, and any impact or disruption, whether natural or human induced, has the potential to affect vast numbers of people (Sensitivity). The expected impacts of climate change pose a massive challenge to cities. These impacts will vary from city to city, as well as within a city.

Cities not only concentrate wealth, people and productivity, but they also concentrate vulnerability to natural disasters and to long-term changes in climate. For example rising sea levels will affect millions of people living in

<sup>2</sup> The increase of global average atmospheric surface temperature is related to the greenhouse effect as a consequence of enhanced emissions of greenhouse gases. Increased global temperature is just one of the consequences of the impacts of human activities on the climatic equilibrium of the planet, with modifications of precipitation patterns, droughts, storminess, ocean temperature and acidification, sea level rise. (IPCC 2001)

coastal cities. Similarly, migration, changes in land use, and spatial development are likely to increase the vulnerability of populations to changes in weather and climate conditions. Moreover cities consider major source of the influences that contribute in changing the climate inside its urban Areas, the urban Heat island effect UHI is a major meteorological phenomenon that associated with rapid urbanization and causing warmness in the urban areas more than its surroundings. The integration of UHI impact with the other environmental issues; causing accelerating in the pace of the climate change inside cities causing cumulative impacts that need complex solutions.

The severity of these impacts will depend in part on the outcomes of global efforts to mitigate climate change. Yet developing countries and poor populations everywhere remain the most vulnerable to impact of climate change. Because they have the least adaptive capacity and often occupy areas that are more exposed to hazards. Building resilience and adapting to climate change are therefore a high priority for cities. That’s why mapping the most risk areas of a city with relevant climate impact-agents is a fundamental step in understanding how to reduce a city’s vulnerability.

Climate change can influence humans directly, through impacts on health and the risk of extreme events on lives, livelihoods, human settlements, Demographic distribution and community behavior and indirectly, through impacts on water, Agriculture, food security and the viability of natural resource-based economic activity. That why Cities that are not striving towards increasing resilience are more vulnerable to risks and threats, not only affecting areas that mentioned previously but also affecting city land uses and urbanism as well. (Arefi 2011)

Table 1. Climate Change Impacts according to the different hazards

Climate Hazard	Potential Primary Impacts	Potential Secondary Impacts
Increased Temperatures	Groundwater depletion	<ul style="list-style-type: none"> <li>▪ <b>Water</b> shortages</li> <li>▪ Distress migration to cities/towns due to droughts in rural areas</li> <li>▪ Reduced <b>food</b> supply and higher food prices</li> <li>▪ Potential <b>energy</b> price increases (e.g. from reduced hydroelectricity generation in places where it exists)</li> <li>▪ Exaggerated <b>urban heat island</b> effect</li> <li>▪ Increased <b>energy</b> demands for cooling</li> <li>▪ Need for higher or additional <b>wastewater treatment</b></li> <li>▪ Population <b>health</b> impacts (e.g. increased mortality during heat waves, decreased access to food/nutrition)</li> </ul>
	Water shortages	
	Drought	
	Degraded Air quality (smog)	
Increased Precipitation	Increased flooding	<ul style="list-style-type: none"> <li>▪ Reduced <b>food</b> supply and higher food prices</li> <li>▪ <b>Property</b> damage (homes and businesses)</li> <li>▪ Disruption of livelihoods and city/town <b>economies</b></li> <li>▪ Damage to <b>infrastructure</b> not designed to the standards necessary to withstand the occurrences being experienced</li> <li>▪ Distress <b>migration</b> to cities due to <b>floods</b> in rural areas</li> <li>▪ <b>Displacement</b> and <b>population movement</b> from informal settlements built on steep slope hazard lands, etc.</li> <li>▪ Increased vector borne <b>diseases</b> (malaria, dengue, encephalitis) and water borne diseases (acute diarrhoea, cholera, dysentery)</li> </ul>
	Increased risk of landslides or mudslides on hazardous slopes	
Sea Level Rise	Coastal flooding	<ul style="list-style-type: none"> <li>▪ <b>Displacement</b> and <b>population movement</b> from coastal areas</li> <li>▪ <b>Property</b> damage (homes and businesses)</li> <li>▪ Damage to <b>infrastructure</b> not designed to the standards necessary to withstand the occurrences being experienced</li> <li>▪ Disruption of livelihoods and city/town <b>economies</b></li> <li>▪ Reduced <b>food</b> supply and higher food prices</li> <li>▪ Population <b>health</b> impacts (e.g. injuries, increased mortality and illness)</li> <li>▪ Loss of productive/residential land due to erosion</li> </ul>
	Salt water intrusion into groundwater supplies in coastal areas	
	Increased storm surge hazard	
	Coastal erosion	
Increased Extreme Weather Episodes (storms,	More intense flooding	<ul style="list-style-type: none"> <li>▪ <b>Property</b> damage (homes and businesses)</li> <li>▪ Damage to <b>infrastructure</b> not designed to standards of occurrences being experienced</li> <li>▪ Population <b>health</b> impacts (e.g. injuries, increased mortality, distress)</li> </ul>
	Higher risk of landslides/ mudslides on hazardous slopes	
	Intense and disastrous wind speeds	

- Disruption of livelihoods and city/town **economies**
  
- Reduced **food** supply and higher food prices

Source: Planning for Climate Change (A Strategic, Values-based Approach for Urban Planners), United Nations Human Settlements Programme (UN-Habitat), 2014.

### 1.3. Why some Places are more Vulnerable to Risks/ Disasters than Others?

Before addressing this topic we need to clarify that, Vulnerability<sup>3</sup> is the Degree to which a systems (people, places, institutions and sectors) are susceptible to, and unable to cope with, adverse effects of disaster/climate change, including climate variability and extremes.

First we can't generalize the reasons for Why some places are more vulnerable to Risks/ Disasters than others, relating only to its place, because every place has its special character, For example, There is a common concept that, the Coastal Cities are always more vulnerable to disasters than any other cities, but are they so?

The answer is NO, it is not necessary goes that way, because; May be the population in the coastal city is very low – May be this coastal city on a high level than the sea – May be it is not exposed to any risks – or may be it have dense population and expose to risks but has a very successful risk management plan and adaptive capacity. Therefore we can't generalize any concept when dealing with Disaster management, considering what we mentioned previously we can now indicate that There are three main factors that can determine which place can be more vulnerable to risks/Disasters, referring to the population/inhabitants for the place that will accrue to that risk/disaster (Sensitivity), the environmental measurements or history of the place in having such disasters before (Exposure) and the community preparedness for confronting or mitigating this risk/disaster impacts (Adaptive Capacity). The following will explain the relation between those three factors and its definitions in details.

**The Vulnerability = (Exposure + Sensitivity) – Adaptive Capacity** ..... (1)



Fig. 1. The Vulnerability Framework - (UN-Habitat, 2014)

**Exposure:** The nature and degree to which a system (People, property, or other elements present in hazard zones) is exposed to Disaster or significant climatic variations and subject to potential losses today and in the future for the city/region.

**Sensitivity:** The degree to which exposed people, places, institutions and sectors are impacted, either positively or negatively, by disaster today and the degree to which they could be impacted in the future. The sensitivity analysis is based on the socio-economic and physical realities, which represent the underlying causes for disaster impact.

**Adaptive capacity:** The degree to which people, places, institutions and sectors are able to adapt to disaster impacts. Adaptive capacity typically is indicated by socio-economic and environmental factors and local realities that enable a

<sup>3</sup> Technically we cannot measure the vulnerability; because it is a concept, but we can operationalize it.

city or community to adjust its system in view of current and future risks. It may also include factors and conditions that leverage new climate conditions to become new opportunities<sup>4</sup>.

Table 2. Vulnerability main factors (Framework)

	Data Required	Sources
<b>Exposure</b> External dimension (Biophysical)	▪ Current climate risks	▪ National and local Observations.
	▪ Climate trends and scenarios (local/National/Global).	▪ IPCC, local models, National CC communications.
	▪ Hazard Maps	▪ City/National map.
<b>Sensitivity</b> Internal dimensions (Social)	▪ Socio-economic profile.	▪ City Data.
	▪ Land-use Plan.	▪ Land-use Plan.
	▪ Key Physical character.	▪ City Data.
	▪ Economic / Livelihoods.	▪ City Community Data.
	▪ Individual vulnerability.	▪ Survey, qualitative, gender, class analysis.
<b>Adaptive Capacity</b> Internal dimensions	▪ Institutional set-up	▪ Institutional mapping.
	▪ Policy, legislation.	▪ Policy analysis.
	▪ Social capital.	▪ Stakeholders' analysis.
	▪ Governance.	▪ Decision making analysis.
	▪ Disaster risk reduction.	▪ Social network analysis.
	▪ Health system.	▪ Participatory tools of hazard Mapping.
	▪ Education.	

Table 3. Measuring Sensitivity (Impacts)

A. Primary Impact	<b>1. People</b>	1.1. Population densities (current and projected).
		1.2. Informal settlements.
		1.3. Vulnerable population densities (poor householders).
		1.4. undiversified livelihood sources
B. Secondary Impact		2.1. Major infrastructure.
C. Tertiary Impact	<b>2. Places</b>	2.2. Critical infrastructure.
		2.3. Key Environmentally sensitive areas.
		2.4. Land Uses.

## 2. Understanding the Cities' resilience

The Objective of all Strategies and plans that concern with mitigating, reducing and even preventing the disasters<sup>5</sup> and Crisis impacts is to have liveable cities or at least resilient cities, which characterized by its capacity to withstand or absorb the impact of hazard through resistance or adaptation, for enabling it to maintain certain basic functions and structures during a crisis and recover from an event. The United Nations Environmental Programme (UNEP 2007) has stated that a successful city must balance social, economic and environmental needs, it should also put the needs of its citizens at the top of all its planning activities. A successful city recognizes its natural assets, its citizens and its environment and builds on these to ensure the best possible returns.

Resilience is a Complex Concept, Hence the definition of resilience varies depending on discipline, perspective and scientific background. Those definitions are differ in their scope, complexity and context dependent concept. In the context of environmental management and sustainability, resilience is the capacity of a social-ecological system to absorb disturbance, change, reorganize, and thereby retain essential functions, structures and feedbacks. (Carpenter 2012).

Because city resilience is a complex and multidisciplinary phenomenon, it requires cooperation between various actors working within governance, spatial, economic and social urban dimensions. It is an emerging concept within

<sup>4</sup> More precipitation in particular areas may lead to new opportunities in urban agriculture or rain water harvesting

<sup>5</sup> Disaster can be defined as a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (UNDHA 2001).



both urban planning and designing, and requires increasing efficiency such as sustainable energy production; decreasing reliance on oil and non-renewable resource consumption as well as localizing economic development (Arefi 2011).

Resilience and Vulnerability can be seen as separate concepts, but there are linkages between vulnerability and resilience, especially with regard to Adaptive Capacity which refers to the ability of a system to adjust to climate change to moderate potential damages, take advantage of opportunities, or to cope with the consequences (IPCC,2001). Adaptive capacity is a measure of many factors, such as (Dependency on Economical resources, Access to Financial resources, Access to technological and information resources, Access to health services, the institutional environment, Land entitlements, Social networks, Political Influence).

It is also important to point out that resilience differs from the general concept of sustainability. Andrew Zolli (Zolli 2012) argues that "...sustainability aims to put the world back into balance, while resilience looks for ways to manage in an imbalanced world". However the sustainable concept still can be embedded into the climate change management Action plan targeting the resilience to our cities.

### 3. Planning for Climate Change (A step forward to livability)

As we mentioned previously how climate change affect our cities and our life and its sustainability, we must confirm that the impacts of climate change will vary over time and from place to place. Exactly how, where, and when these effects will play out, is difficult to predict.

The importance of having Climate Change Action Plans is to translate - often vague - strategies for adaption and mitigation into concrete actions. Which mainly based on vulnerability assessment, mitigation and adaptation assessment and consider the (financial) constraints of the particular city. However many cities can apply no-regrets policies that work within the existing system. These can then be scaled-up when necessary. Such a future-proof approach prevents maladaptation and ensures appropriate action can be taken when certain changes in the conditions are reached. Cities should mainstream adaptation/mitigation actions across all sectors of urban development; crucially this must occur in urban development and land-use planning.

Importantly to make sure that, climate change mitigation and adaptation should not be treated as two separate goals. Planning priority should be given to actions that contribute to both adaptation and mitigation and its co-benefits and mainstream those actions with the development local/strategic plans.

#### 3.1. How to deal with climate change? (What is the climate change management?)

When dealing or Preparing/managing climate change we plan for uncertainty and in this issue we always have three main strategies (**No Regrets Strategies**: Provides benefits now with or without climate change, **Low Regrets Strategies**: Provide climate change benefits for little additional cost or risk, **Win-win** or **Co-benefit Strategies**: Reduce climate change impacts while providing other environmental, social, or economic benefits).

Adaptation and Mitigation are the main highlighted Strategies when dealing with Comprehensive Climate Change management strategy, however We can't separate the Adaptation Actions and Mitigation Actions for Climate change completely, otherwise it will be wasting for the efforts, time and money, however this study will explain them separately for the theoretical study and afterwards we will show how to make co-benefits from both of them.

**Adaptation** (short term strategy): Preparing for the system changes, reducing vulnerability by understanding climate hazards, reducing exposure and sensitivity. Adaptation policy is crucial for dealing with the unavoidable impacts of climate change, but this has so far been underemphasized at the urban level around the world.

Adaptation addresses the consequences of climate change, such as heavy rainfall, flooding, or extreme temperatures. These are issues already affecting societies, independent of their role in causing climate change. As a result, the benefits from urban adaptation can be direct for a city, in contrast with the rather indirect benefits felt in the case of mitigation in the form of political or economic gains or improvements in the local environment. Not only does adaptation provide many local benefits, it can also be realized without long lead times (Stern 2006).

The Two main types of Adaptations strategies are:

**Reactive adaptation**, which involves a deliberate response to a climatic shock or impact, in order to recover and prevent similar impacts in the future. One of its major disadvantages is running the risk of being short-sighted by

focusing on the crisis at hand. In many cases it is used for unexpected consequences that may happen out of planned/designed confronting scenario.

**Anticipatory or proactive adaptation**, which involves planned action, in advance of climate change, to prepare for and minimize its potential impacts (taking steps to reduce the risks associated with climate change for individuals, communities and ecosystems), Proactive planning is often more effective and less costly than reactive planning, and can provide benefits today.

The main facts about adaptation are that:

- Lack of (financial resources, certainty of cost, institutional oversight, information, flexibility, access to new technology) and also Social barriers are the main Barriers to adaptation.
- Adapting to climate change is not a one-time activity.
- There is no “one-size-fits-all” approach to managing climate change impacts (it depends always on other factors per each region and city).
- Much can be gained from addressing non-climate stresses that contribute to climate vulnerability and risks.
- Proactive, long-term Strategies are cheaper than reactive, short-term ones.
- The Main Objective for any Adaptation Strategy are (Reduce exposure, decreasing sensitivity and increasing adaptive capacity).

**Mitigation** (Long term strategy): It is about reduction of GHG emissions by type of GHG, source, location.

Cities are responsible for two-thirds of global energy consumption, and this proportion is expected to grow further (IEA 2008). A fundamental step for cities when it comes to climate change mitigation is to quantify the GHG emissions attributable to cities. Emissions must be measurable to be manageable, various methodologies for measuring city GHG emissions have been developed, although most efforts have sought to follow IPCC guidelines, considerable variation is found among these methodologies (Bader and Bleischwitz 2009).

However in the way to determine how exactly GHG emissions should be attributed geographically, another basic issue lies in the definition of the city for the purpose of measuring emissions, whether based on administrative borders, metropolitan area, or a functional economic space. This consider very important issue because; a variety of factors influence a city’s emissions profile in complex ways. These factors include urban form and land use patterns, climate, building design and technology, transport modes, and income levels. The emissions profiles of cities can be very different depending on specific city contexts. But in difference with adaptation plans which demand a specific actions differentiate according to each region, the mitigation Strategies in cities can learn from one another when developing and implementing mitigation strategies, however specific solutions and mitigation measures may not be easily transferable or directly relevant for other cities.

Table 4. Comparing between Mitigation and Adaptation main Issues

	<b>Mitigation</b>	<b>Adaptation</b>
<b>Goal</b>	Sustainable development	Sustainable development
<b>Characteristics</b>	Climate change impact reduction by reducing GHG in a long period	Effective response to climate change in a short period of time
<b>Benefited part</b>	World or local communities	Local communities
<b>Coop. counterpart</b>	International society/Nation	Local regions
<b>Areas</b>	Greenhouse gas emission reduction	Various areas
<b>Types</b>		Reactive adaptation & Anticipatory (planned) adaptation

As mentioned previously, there is a distinctive difference between mitigation and adaptation in order to increase the resiliency of systems such as cities. Mitigation stand for reduction efforts in order to avoid future impacts, while adaptation focuses on coping with and adjusting to already unavoidable events caused by disturbance and change (Hamin & Gurran 2009).



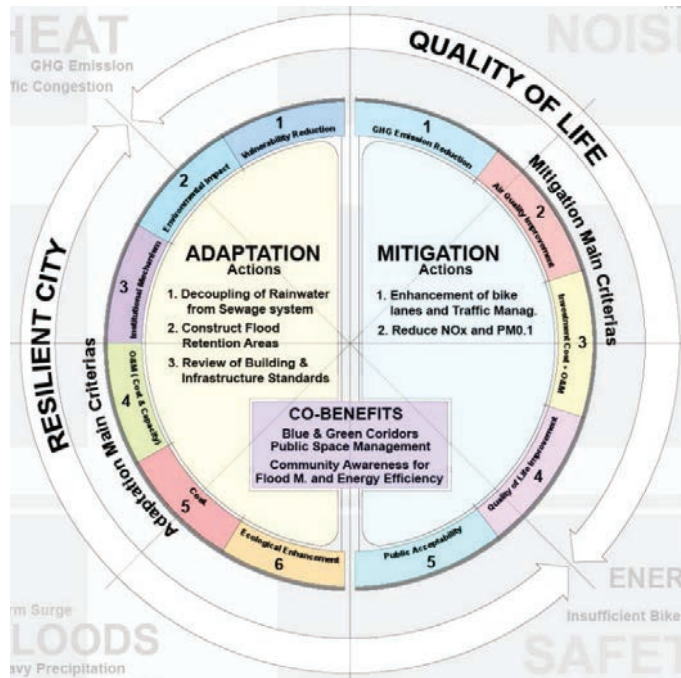


Fig. 2. Example for integrating Actions in the CC Plan - (Ghoneem M., 2014)  
 It present how we mainstreamed the Adaptation, Mitigation and their Co-benefits actions into existing City development plan, according to specific criteria that were chosen from multi-alternative list.

**Cities and climate change Initiatives**

Many initiatives were made concerning planning and reducing the impacts of the climate change Such as UN climate change initiatives, C40 initiative, European green capital initiative, but are all related cities planning and drawing policies for climate change only as an international Trend, or there are some cities have already changed its planning and formation according to those policies and plans?

Approximately 20 percent of cities around the globe have developed adaptation strategies, according to a 2011 estimate by researchers at the Massachusetts Institute of Technology. A lack of funding to pay for comprehensive analysis, a focus on other municipal priorities and a shortage of qualified staff is often some of the major problems that faces the CC management team. Some of world’s most comprehensive cities’ initiatives will be presented in the next Table (5).

Table 5. Sample for Extensive Climate Adaptation Plans.

	Region	Initiative/ Strategic Plan	Description
2004	Durban, South Africa	Africa's most caring and liveable city	Initiated in 2004 by the city's Environmental Management Department. The strategy was conceived in large part to help fulfil the municipal government's goal of being "Africa's most caring and liveable city" by 2020.

	Developing		<p>Durban has rolled out its climate adaptation in stages under the Municipal Climate Protection Program, one of the earliest efforts of its kind. Nine years ago, the program began assessing the local impacts of climate change namely hotter average temperatures, intense rainfalls and coastal erosion by using downscaled global models, the method deployed in Chicago. Next, the city created a Headline Adaptation Strategy to study the vulnerability of each municipal agency to such impacts.</p> <p>In 2008, city staffers began developing specific adaptation plans with 48 total proposals for the health, water and disaster management agencies a notable contrast to New York City's integrated, citywide approach. Durban's environmental planning department is tasked with monitoring the implementation of the agencies' plans on a quarterly basis. A recent report outlines the dozens of initiatives underway.</p> <p>Despite years of planning, agencies have only been able to tap municipal funding for long-term projects in the past couple of years; international donors funded much of the initial work. Some \$30 million in adaptation projects were underway in Durban in 2011.</p>
2007	<b>Quito, Ecuador</b>	Quito's climate change strategy	<p>Started in 2007 by the Quito Metropolitan Council, which formally approved the Quito Climate Change Strategy in October 2009. The push for the plan came six years ago when the steep-sloped Andean city of 2.1 million residents hosted that year's Clima Latino, a regional climate change conference. The city was also experiencing an increase in landslides, floods and droughts, along with the shrinking of the nearby Antisana glacier.</p> <p>Quito's climate change strategy includes both mitigation and adaptation initiatives. Its adaptation component focuses on five key sectors: ecosystems and biodiversity, drinking water supplies, public health, infrastructure and power production, and climate risk management. The report draws on global climate models by the IPCC for impacts at similar altitudes and latitudes as Quito.</p> <p>According to a 2013 case study on Quito, the city so far has invested nearly \$350 million in adaptation using a mix of municipal dollars, international aid and philanthropic funding.</p>
	Developing		
2008	<b>Chicago, USA</b>	Chicago Climate Action Plan	<p>Announced in September 2008, The "Chicago Climate Action Plan" is mainly a mitigation strategy for the city of 2.7 million people. At the time, the plan was the first to both identify sources of greenhouse gas emissions and their subsequent impacts, and to propose ideas that respond to those findings.</p> <p>The adaptation Strategy outlines nine initiatives for dealing with intensely hot summers, thick smog, flooding and heavy rains though most proposals call for further study rather than actual projects. A 2010 progress report noted significant adaptation work was underway on green buildings, storm water management projects, tree planting and green roof installations that absorb rainwater. Overall, the city developed more than 450 mitigation and adaptation initiatives in the first two years of the climate plan. City staffers worked with climate scientists from the IPCC to "downscale" global data on sea level rise and other impacts to Chicago's level. The city's climate strategy doesn't outline a budget for proposed initiatives, though Oliver Wyman, a risk management firm, estimated that Chicago would suffer hundreds of billions of dollars in economic damages by 2050 if it failed to take climate action.</p>
	Developed		
2008	<b>Rotterdam, Netherlands</b>	Rotterdam Climate Proof	<p>Rotterdam Climate Proof is initiative Launched in late 2008 by the Rotterdam Climate Initiative, a joint program of the city government, the regional environmental protection agency, the port authority and the port employers' association.</p> <p>It aims to make the city of 1.3 million people "fully" resilient to climate change impacts by 2025 and to maintain Rotterdam's status as one of the safest port cities in the world. The adaptation strategy contains five themes: flood management, accessibility for ships and passengers, adaptive buildings, urban water systems, and quality of life within the city. The city set aside about \$40 million for implementation of the plan's near-term projects.</p> <p>A 2010 follow-up report notes the initiative is making "full progress" toward its initiatives and broader goals. Perhaps the most notable project to come from the plan is Rotterdam's trio of floating pavilions. The bubble-shaped domes are anchored off the city's waterfront and measure a total of 12,000 square feet. The project is a pilot for future floating urban districts that will be able to rise with the changing sea levels.</p>
	Developed		

2011	<b>London, UK</b>	Managing Risks and Increasing Resilience	<p>This Plan was Adopted in October 2011, The adaptation strategy was developed in response to rising concerns about persistent flooding, drought and extreme heat waves in the city.</p> <p>London's adaptation plan is based on national climate change projections from 2009 created by the UK's official centre for climate change research, the Met Office Hadley Centre. Unlike New York, the city doesn't detail the expected cost to implement the proposed initiatives. London's separate flood risk management plan for the Thames River, however, would cost the city about \$2.3 billion in its first 25 years.</p> <p>The final report, "Managing Risks and Increasing Resilience," analyses the threat of global warming impacts to the city and identifies the residents and infrastructure that are most vulnerable. It also proposes 34 initiatives to protect and strengthen the city, including three key actions: managing the risk of surface water flooding, increasing the amount of parks and vegetation in the city, and retrofitting more than one million homes by 2015 to improve water and energy efficiency.</p>
	Developed		
2013	<b>New York City, USA</b>	A Stronger, More Resilient New York	<p>It was Launched on 2013, and it was developed in response to super-storm Sandy, which pummelled 1,000 miles of the Atlantic coastline last October and cost \$19 billion in damage and economic losses to the city of 8.2 million people.</p> <p>The plan was based on hyper-local climate models specific to New York City. The models come from the Intergovernmental Panel on Climate Change's (IPCC) upcoming Fifth Assessment Report, which can project future climate in more detail and on a smaller scale than previous models.</p> <p>It proposes more than 250 initiatives to reduce the city's vulnerability to coastal flooding and storm surge. About 80 percent of the \$19.5 billion plan will go to repairing homes and streets damaged by Sandy, retrofitting hospitals and nursing homes, elevating electrical infrastructure, improving ferry and subway systems and fixing leaky drinking water systems. The rest will go to building and researching floodwalls, restoring swamplands and sand dunes, and other coastal flood protections.</p>
	Developed		

### 3.2. How to Plan for Climate Change Action Plan?

First of all we must mention that climate change Action Plans are not predictions of the future it is mostly Scenarios for a range of possible and consistent futures, those Scenarios say nothing about how likely a certain scenario is, nor which is the most likely to occur, but it draw comprehensive/ detailed actions and procedures for mitigate or prevent the climate change impacts when it occurs. Its development plan and its methodology are as follow in its most plans.

#### The Development Plan:

1. Data Collection and Scenario Elaboration.
2. Risk and Vulnerability Assessment (Cultural Heritage, Soil Consumption, Mobility Infrastructure, Heat Wave, Water Security) - Sensitivity, impacts and vulnerability.
3. Participatory Process (Thematic session, Focus Group, one-to-one Meeting, Training and Educational Activities).
4. Local Adaptation Plan.

#### The Methodology when Making the CC Action Plan:

1. Scope of the Plan
2. Vulnerability Assessment/GHGs emission assessment.
3. Adaptation Plan (Actions & Impacts).
4. Mitigation Plan (Actions & Impacts).
5. Resilience Plan.
6. Implementation Plan.

#### How to make the prioritizing for the Actions in each phase in this plan?

Climate adaptation is a challenging task due to the complex issues of uncertainties for the future. While most decision makers, at all levels and various sectors, recognize the need to adapt, there still exists a mismatch between the decision maker requirements and available research outputs (Trueck 2013).

Many decision-makers such as local governments depend on extensive research consultations to decide on adaptation investments. This renders them ignorant about the hidden uncertainties and assumptions behind the research results. Moreover and according to the dangerous of taking decisions based on average values that do not reflect sensitivities of the results or worst-case scenarios. Many tools was created to prioritizing the Climate change actions to support the decision makers such as (Simulation model within game mode (Decision maker support – Community Awareness). The main Goal for those tools is to enable researchers to analyse and prepare for catastrophic and climate impacted hazards in a less predictable, complex world. The developed tools allows local government and other stakeholders to compare and prioritize investment in climate adaptation. It also allows the user to conduct sensitivity tests, examining the impact of uncertain parameters ranging from possible climate impacts on the catastrophic risks to economic factors such as growth or discount rates.

### 3.3. What are the main challenges that the developing countries faces in planning for climate change?

Managing climate change in developing countries is vital and has been highlighted by them as having a high or urgent priority. Although uncertainty remains about the extent of climate change impacts, in many developing countries there is sufficient information and knowledge available on strategies and plans to implement adaptation/mitigation activities now. However, developing countries have limitations in capacity making adaptation difficult. Limitations include both human capacity and financial resources (UNFCCC 2007).

Many developing countries face difficulties in integrating climate change concerns into national policies due to a lack of resources and institutional capacities. Planning for climate change must involve consideration of climate related risks including those which have a slow onset, such as changes in temperature and precipitation leading to agricultural losses and drought and biodiversity losses, and those which happen more suddenly such as tropical storms and floods.

Another important adaptation strategy is economic diversification within sectors to reduce dependence on climate sensitive resources, particularly for countries that rely on narrow ranges of climate-sensitive economic activities, such as the export of a climate-sensitive crop.

Procedure to identify the challenges and opportunities in the multilevel governance is a must to make efficient steps towards increasing resilience, such as:

- A national framework: the national level should provide a framework to fund local adaptive needs.
- Capacity building for local government practitioners is essential.
- Enforcing adaptation plans can be difficulty for local governments such as no-build zones in floodplains, especially in rapidly urbanizing Areas.
- Political changes can stop progress in local governments.
- Dispersed governance at the local level makes it difficult to make decisions with a global vision.

## 4. Conclusions and Discussions

According to what mentioned previously we can determine the main conclusions as following:

**First:** All developed/developing countries, need to adapt to climate change, and this will be costly. Developing countries, have little capacity (both in terms of human capacity and financial resources) to adapt. Financial means must be found to enable developing countries to enhance their capabilities to adapt.

**Second:** In many developing countries there are difficulties in integrating adaptation concerns into national policy due to low staff capacity for planning, monitoring and evaluation; poor data on adaptation options and lack of information sharing and management across sectors. Moreover Lack of cooperation among ministries was highlighted as a major barrier to progress on adaptation.

**Third:** As climate change increases the potential for climate related risk, it is also important that risk management and risk reduction is incorporated into adaptation planning at all levels, and that climate change is incorporated into disaster and risk management activities.

**Fourth:** Local governments have a variable level of influence over GHG emissions through their roles in energy supply and management, transport, land use planning, and waste management. Putting in consideration that, municipal emissions account for only a small percentage of the overall GHG emissions from a city, though where a municipality owns the energy or Water Supply Company.

**Fifth:** Although some municipalities have developed a systematic approach to climate Strategies through the stages of undertaking inventories of GHG emissions and determining emissions reduction targets, climate change action plans, and various implementation plans, which have adopted GHG reduction targets, have failed to pursue such a systematic and structured approach and, instead, prefer to implement no-regret measures on a case by case basis, such as energy efficiency incentive programs, educational efforts, green local government procurement standards, public transportation policies, public-private partnership agreements with local businesses, and tree planting.

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