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The City Facing Climate Change: Which City for Tomorrow?

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Abstract

Summary: *Reflection on the theme of the city of tomorrow is justified by the importance and speed of the profound changes that the world is experiencing such as the globalization of economies, the demographic explosion or climate change. According to the Intergovernmental Panel on Climate Change (GEIC, 2020), climate change constitutes an existential challenge for all of humanity.*

Caused by human activity, global warming has unfortunate consequences on humans and the ecosystem. The city is responsible for climate disruption through the Emission of Greenhouse Gas (GHG), it is also very impacted by the effects of the climate crisis: the excessive rise in urban heat and the rise in ocean levels which can lead to the total or partial marine submergence of coastal cities, are the main threats to urban territories.

To adapt to this worrying climate change and mitigate its effects, States must make sustainable cities the lever of strategies to combat global warming. This means that integrating the requirements of climate change into urbanization policies is more of a necessity than a choice to build the city of tomorrow that is sustainable and resilient.

However, the realization of the sustainable city project is limited by economic, institutional and political constraints. Review ways of thinking and acting on the question of urban planning at all levels of governance from local to global on the one hand and the reduction of social and spatial inequalities between and intra-nations on the other hand.

Keywords: City, Adaptation, Mitigation, Climate, Sustainable

Introduction

Experts and scientists agree that climate change, caused by global warming, poses an existential challenge for all of humanity (Intergovernmental Panel on Climate Change, 2020).

The city has largely contributed to global warming through strong Greenhouse Gas (GHG) emissions due to the artificialization of space, energy consumption and various pollution. Paradoxically, the city has become, over time, a victim of global warming through an "urban heat island" effect and the rise in ocean levels which can lead to the total or partial marine submersion of coastal cities [1].

In this context and under pressure from the Intergovernmental Panel on Climate Change (IPCC) , the international community is engaged in a process of combating climate change and adapting to its effects. Two decisive components of the process deserve particular attention from global decision-makers: developing countries and cities. Developing countries which are low emitters of greenhouse gases but suffer the negative effects of climate change, deserve increased and multifaceted assistance as such and the cities to which we dedicate this article [2].

Sustainable Cities "Built or Renovated" Should Constitute a Crucial Lever in the Climate Strategy for at Least two Reasons

- Cities are the biggest polluters since they alone emit 60% of

greenhouse gas emissions. This share tends to increase with the expansion of cities and the growth of urban populations.
- The current urban population represents more than half of the world population concentrated on only 2% of the planet's surface. Projections from the United Nations (UN) estimate that nearly 68% of the planet's inhabitants would live in urban areas by 2050.

For these reasons, the focus of the strategy of adaptation and mitigation of the effects of climate change on urban space becomes a priority and a necessity for the success of climate policies.

However, mastering the issues linked to the realization of the city of tomorrow encounters economic, ecological, institutional and political constraints specific to each territorial context.
Solutions to these constraints exist but require, for their activation, a reconsideration of the relationship between man and nature in the sense of the greatest respect and intra- and intergenerational solidarity.

Thus, the purpose of this paper is to contribute to the debate on the problem formulated below:
To What Extent Can the Sustainable city of Tomorrow Become a Reality in the Current Context of Global Warming?
The methodological approach adopted to answer this question will be carried out in three stages:
- Identify the interaction between the urban climate and the global climate
- Discuss the issues and constraints of the sustainable city as a lever in the strategy to combat climate change.
- Draw conclusions from experiences undertaken in the field before presenting, in the form of a recommendation, the conditions required for the realization of the sustainable city.

The Interaction Between Global Climate and Urban Climate
As the largest polluter, the city has played a decisive role in accelerating the process of global warming, the consequences of which it is suffering.

1<Global Warming in the World: Current Situation and Perspectives
The United Nations Framework Convention on Climate Change (UNFCCC) defines, in its first article, climate change as "climate change which is attributed directly or indirectly to human activity altering the composition of the global atmosphere and which adds to the natural climate variability observed during comparable periods" Climate change is resulting in unprecedented warming of the planet and the recurrence of extreme weather phenomena that threaten humanity [3].

Expressions such as "humanity is heading towards ruin", "the planet earth is suffering martyrdom" often appear in literature to sound the alarm about the seriousness of the climate situation.

Currently, global warming shows no signs of slowing down and the outlook in this area is bleak and does not bode well. The average annual temperature of the earth's surface, which has reached 1.1° since the pre-industrial era, is expected to increase by the end of the century (2071-2100 compared to 1971-2000) by 1.0 to 4.5°C. This means that over the coming decades the temperature will continue to rise, which would further increase the frequency and intensity of heat waves, hurricanes, floods, the melting of glaciers, etc.

The main cause of climate change is the concentration in the atmosphere of greenhouse gases linked to human activity based on the excessive use of fossil fuels (coal, oil and gas).

More than 75% of global greenhouse gas emissions and nearly 90% of all carbon dioxide emissions originate from human activity, particularly urban activity.

The City "Actress" of Global Warming
Over time, cities and global urban populations have grown significantly. Considerable. Indeed, in the last fifty years alone, the world's urban population has quadrupled from 1.19 billion in 1970 to 4.46 billion people in 2022, or nearly half of the world's total population. Projections from the United Nations estimate that nearly 68% of the planet's inhabitants would live in urban areas by 2050.

For this reason, cities are the biggest polluters since they alone emit 60% of greenhouse gas emissions even though they occupy only 2% of the planet's surface.

The main factors which contribute decisively to the rise in urban temperature are anthropization, energy consumption and pollution.

Anthropization
Anthropization or artificialization refers to the modification of a so-called "natural" environment by human activities which consequently generate the modification of the environment due in particular to the impermeability of the natural cover. Through this artificialization of the environment, the city becomes the seat of a specific climate that meteorologists call "the urban heat island", which "consists of a higher temperature in the city than in the suburbs, themselves hotter than the surrounding countryside" .

Meteorologists estimate that in the future heatwaves will become more frequent and intense, especially in urban areas. "The coupling between the urban climate on the one hand and climate change on the other hand leads us to believe that the vulnerability of the city and cities in general should increase in the future"

The Use of Fossil Energy on a Large Scale
Cities consume essential resources such as energy and water. They also serve as key transportation hubs, emitting significant amounts of carbon through extensive road networks, mass transit systems and airports. According to data provided by the United Nations-Habitat (2023), cities account for 78% of global energy consumption. The urban use of energy necessary for the uninterrupted functioning of the city (administrations, public lighting, transport), for economic activity (commerce, industry, services) and for domestic use (cooking, air conditioning) generates no less than 80% of carbon dioxide in the world and very significant volumes of other greenhouse gases (GHG) (carbon monoxide, sulfate oxides, nitrogen). Emissions from transport are increasing at an alarming rate of 3% per year, loading the air of cities with significant quantities of carbon dioxide.

Various Pollution

Urban sources of pollution include activities that rely on the use of carbon-based fuels in activities such as transport, buildings and electricity generation. They contribute to global warming through the emission of greenhouse gases which currently amounts; it should be remembered, to 60%. This level of emissions is likely to become even more significant in the near future under the combined effect of a certain number of factors including the increase in urban populations, the form of city expansion, the evolution of architectural methods, the mode of urban transport, the lifestyle, energy consumption, etc.

The City Victim of Climate Change

Currently, cities face several risks linked to climate change such as heat waves, floods and marine submersion for coastal cities as the IPCC points out, "Cities, where half of the world's population lives, face a myriad of risks linked to climate change: Floods, marine submersion, heat islands..." . The effects of global warming on cities can be observed on various economic, social and environmental levels. They negatively impact growth, employment, water, food and energy security, etc. Its impact on health and the quality of urban life can lead to death and illness due to extreme weather events. The exceptional heatwave which hit the French capital for around ten days in August 2003, causing more than 15,000 deaths, is a perfect illustration. Climate disruption also creates climate refugees who amplify increased inequalities, particularly in developing countries where cities are facing a growing rural exodus.

For urban areas located on the lowest coasts, the harmful effects of climate change noted for continental cities are doubled by the risk of total or partial submergence due to rising sea and ocean levels. The estimates and forecasts, provided by the Intergovernmental Panel on Climate

Change (IPCC), Regarding Sea Level Rise, Are Alarming in more than one Way:

- Extreme weather events (rainfall, droughts, heat waves) are becoming more and more intense and frequent. The IPCC predicts an increase of 82 cm by 2100 in a scenario without reduction in greenhouse gas emissions.
- No less than 25 megacities will be affected by rising sea levels if the level of global warming reaches 2°C to 2.5°C.
- The flooding of ports and airports built on high-risk land would cause the disappearance of nearly 338 units if warming reaches 2°C.
- The Situation of Cities in Developing Nations like Morocco, a Southern Country Facing Development Problems, is no Less Alarming for at Least two Reasons:
- The urban population, which currently accounts for more than half of the country's population, is expected to reach 81% by 2050, posing crucial challenges in climate planning and governance.
- *The maritime coastline has a length of more than 3,400 km, including 2,934 km on the Atlantic Ocean and 512 km on the Mediterranean Sea. This position means that the kingdom would be one of the countries most affected by climatic scourges. According to the Moroccan online site Médias 24 , more than 16 Moroccan cities are threatened by the phenomenon of rising water levels on the Mediterranean and Atlantic coasts. The conclusions of a climate study published by the journal "Communications Environment, 2024" are no less alarming: "several Moroccan coastal cities, within around thirty years, could completely disappear following the rise in sea level due to global warming (……). Basically, the kingdom will suffer great damage if the necessary measures are not taken by then."

For all these considerations, the development of sustainable cities should play a crucial role in the strategy to combat climate change.

The Sustainable City, A Lever in the Strategy to Combat Global Warming

Beyond the territorial specificities of countries and their levels of development, urban planning experts believe that the context of the fight against climate change requires a transition from the city model resulting from the "industrial revolution" to that of the "post-carbon" period. The study of the sustainable city as a lever for the strategy to combat global warming poses two questions.

-How could the sustainable city meet the challenges of urban heat and protect itself against the risk of marine submersion?
-What are the constraints to the development of sustainable cities?

The Challenges of the Sustainable city: Urban Heat and Marine Submersion

To meet the challenges of urban heat and marine submersion, cities have a lever of economic, regulatory and institutional tools to rethink urban space through sustainability actions.

Economic, Financial and Legal Instruments: Standards, Taxes, Exchangeable Permits

The economic, financial and legal instruments used by States and municipalities such as standards, taxes and exchangeable permits aim to encourage actors, particularly urban ones, to decarbonize their activities and regulate pollution. They contribute to improving the energy efficiency of buildings, expanding access to clean energy, promoting low-carbon transport and managing solid and liquid sanitation.

It is established that the implementation of these measures and their economic, social and environmental efficiencies encounter major difficulties linked, in particular, to the precise definition and effective implementation of standards, taxes and rights to pollute.

The protection of nature, including urban territories, is governed in part by binding international treaties signed by States which municipalities must respect.

Urban Sustainability Actions

The priority actions to be undertaken concern areas relating to vegetation, air conditioning, urban architecture, the achievement of sustainable development objectives (SDGs) and the protection of coastal cities.

Vegetation

The vegetation of urban space plays the role of a natural air conditioner through the creation of ecosystems that are more resil-

ient to global warming. It aims to "bring nature back to cities" with a view to moderation, greening and cooling the air temperature in the streets. The development of vegetation and the green economy in general offers multiple advantages such as reducing the carbon footprint of existing activities and therefore the sustainability of the development model, taking advantage of opportunities in terms of growth and jobs associated with it, etc.

However, revegetation requires the availability of space and water resources in sufficient quantities to guarantee the development and functioning of this vegetation and its effectiveness. Thus, urban vegetation refers to the problem of the appropriate use of the space to be vegetated and of water in the city, particularly in the summer context and drought.

Air Conditioning

Air conditioning, which protects residents against intense heat, plays a vital role in reducing temperatures and thus contributing to the fight against global warming. However, the large-scale use of air conditioning does not seem to constitute an unimpeded solution to the phenomenon of urban heat islands, for the reasons indicated below.

-The massive use of air conditioning or heating necessarily poses serious problems in terms of electrical energy consumption.

-Air conditioning aggravates the urban heat island, in particular by the rejection of hot air outside buildings equipped with air conditioning, which significantly increases the air temperature in the street. As a result, air conditioning directly contributes to global warming.

-Air conditioners are not accessible to the most disadvantaged groups, which limits the generalization of air conditioning and therefore its effectiveness with regard to the effects of urban warming.

Urban Architecture

The current city contributes to the increase in heat through energy consumption in the manufacturing of urban housing components (cement, steel, plastics, etc.). The resilient city should generate fewer greenhouse gases and thus reduce the contribution to climate warming by using architectural and construction methods that are mindful of the climate challenge.

In addition, the architecture of the city of tomorrow refers to the strategies for the expansion of the urban fabric and the distribution of the urban population, which can be done according to several modalities (understood, compact, collective, etc.). Each modality impacts the evolution of the urban heat island differently. For example, a more spread out city requires more infrastructures, more space, more travel, more Greenhouse Gas (GHG) emissions, obviously at a higher economic and ecological cost.

Lifestyle

The sustainable city project involves promoting an equally sustainable way of life. This should be more economical in terms of energy use, respectful of the environment and less demanding on natural resources such as water.

The in-depth revision of the way of life in the direction of sustainability also calls for the promotion of energy-saving methods of travel (collective transport, bicycles, etc.).

Achieving Sustainable Development Goals

By adopting resilient urban development, cities can accelerate progress towards achieving the Sustainable Development Goals (SDGs) by 2030. These consist of improving the quality of life and well-being of each city dweller; stimulating the local economy, creating jobs, providing better livelihoods, improving social inclusion, promoting the use of environmental resources etc.

Protection Against Submersion of Coastal Towns

Marine submersion, which is not a new phenomenon, is amplified with climate change and the rise in sea and ocean water levels. It endangers populations, buildings, infrastructure and human activities. Faced with this scourge, urban decision-makers are inclined to act dynamically to identify vulnerabilities, put in place risk prevention measures and means of protection in a proactive manner. The actions undertaken are based on a combination of physical, technical, natural and organizational measures with a view to strengthening the resilience of coastal urban spaces. These measures inevitably lead to the recomposition of urban space and the relocation of populations and activities. It therefore follows that the cost of protecting cities against flooding can exceed the financial capacity of local urban decision-makers in several countries.

Constraints to the Sustainable City Project

In view of the experience of urban policies in developed countries (city of Florence, Paris, Rotterdam, Barcelona etc.), we can argue that the realization of the resilience project encounters two types of major constraints relating to:

- Urban climate governance
- The difficulties of mitigating the effects of climate change and adapting to its consequences.

Urban Climate Governance

Climate governance refers to the institutions and processes and practices of decision-making and regulation relating to climate issues in the urban territory. Good climate governance requires that challenges be overcome to master complex issues. These challenges may include funding constraints, lack of political will, adequate legal and institutional framework and environmental protection laws.

The Difficulties of Mitigating the Effects of Climate Change and Adapting to its Consequences

Climate policy challenges relate to technological, institutional and financial factors. The IPCC 2021 report deplores the delay and obsolescence of climate policies in the face of growing risks. "A worrying disconnect between growing climate risks and already obsolete policies. ". At the urban level, adaptation policies are constrained by the speed of change: "urban adaptation policies caught up by the speed of climate change" (IPCC 2021).

Several Socio-economic and Institutional Factors are at the Origin of the Difficulties of Climate Policies. We will Cite the Most Pressing

- The lack of relevant knowledge about the climate phenomenon and the means to adapt to it.

- Awareness of the decisive role of the city in climate balance deserves to be strengthened and generalized.
- Energy is still largely produced from fossil fuels (oil, gas). There is a need to decarbonize energy production and accelerate the energy transition.
- Uncontrolled urban growth and the phenomenon of urban and peri-urban sprawl, particularly in countries where socio-economic development is still to be done.
- Financing remains the major difficulty and the primary obstacle for adaptation policies. This is due, in particular, to the low financial contribution from the international community. During COP 26 (December 2021), the Organization for Economic Cooperation and Development (OECD) regrets that the climate financing promised by developed countries to developing countries is still far from the promises made in 2009.
- The international community is unable to enforce commitments in this area. The progress made is not only limited but above all exceeded by the speed of climate change.

Conclusions and Recommendations

Overall, the progress made remains weak and is overtaken by the speed of climate change, the actions implemented are insufficient or even limited. The Conferences of the Parties (COP) give birth to a smile; their decisions are not binding. However, the solutions exist but their activation requires radical changes to meet the climate challenge. The international community has no other choice but to act and quickly, the scenario of inaction would have serious consequences.

It is Therefore Imperative to Place Climate Policies Within a Global Framework Whose Main Features Are

- Revision of ways of thinking and acting in human societies in the face of climate risks. The United Nations and its agencies have a crucial role to play in making global warming a political issue at the heart of the concerns of world decision-makers. The World Bank Group must support its client countries in the climate project and involve the private sector and insurance companies in order to control the costs of vulnerabilities and measures to adapt and mitigate climate effects. States, Non-Governmental Organizations (NGOs), political parties, unions and civil society must work together to raise awareness among citizens through a societal dialogue around the climate issue and the central role of the city. The challenge is to make the sustainable city project a political concern strongly claimed by voters.
- The fight against climate change necessarily involves reducing social and spatial inequalities between and between nations. From this perspective, rich countries, historical polluters and main emitters of greenhouse gases, must assume a dual responsibility: that of reducing the emission of polluting gases and that of financially and technically assisting poor countries to reduce theirs.
- It is within this ambient framework that the resilient city could emerge and develop, especially in countries struggling with development problems. Let's remain optimist.

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