

# ***Sustainable Urban Planning and Climate Change Adaptation: Disaster Protection Strategies for Global Urban Development***

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**Abstract:** Urban and rural differentiation emerged since the start of industrial development of human societies. With the need of large amount of human capital to adapt to mass production, rapid urbanization, as a natural course, changed the nature of human lifestyle permanently. Unintended consequences appear along this process of significant economic growth and prosperity, with climate change, which is due to carbon emission, as one of the most prominent problems. Climate change brings various disasters, with typhoons, floods, and wildfires as to name a few. Transition to urban lifestyles, without the realization of sustainability, is one of the primary issues nowadays. This paper discusses the process of urbanization and the usage of crude oils as an automatic method to fuel the cities, and their relations with climate change. It then proposes important criteria to follow for sustainable urban constructions and strategies for disaster prevention.

**Keywords:** Urbanization, Sustainability, Climate Change Adaptation, Sustainable Urban Design, Disaster Protection

## **1. Introduction**

With the rapid development of industrialization and the evolvement of human societies, nowadays more than half of the world population are dwelling in urban areas, for the first time in human history. This urban portion will increase to nearly 60% by 2030 and have a high chance of reaching 70% by 2050 [1]. Urbanization, the process describing the growth of cities and population migration into urban areas, pushes the need for energy so that cities could be built, and lives could be fueled. With the discovery of crude oils and fossil fuels as well as the invention of engines and motors dated as early as very first Industrial Revolution which started in the second half of the eighteenth century, pollution comes onto the stage of human history.

However, it is not until late twentieth century when concepts like environmental protection, tropical island effect, greenhouse gases, clean energies, sustainability, and disaster prevention attracted attention. Rapid urbanization and modern urban lifestyles created convenience for human life, but also brings serious and even disastrous climate change. [2, 3, 4]

Traditional usage of crude oils and fossil fuels play an important role in supporting the development of industries and urbanization. Fossil fuel burning release large amount of carbon dioxide into the atmosphere which traps heat in the environment, and eventually leads to global

warming. This is considered one of the most serious problems of climate change since global temperature increasing results in countless disasters. Iceberg melting causes rising sea level will eventually bring floods and tropical typhoons; high temperature in relative dry forestry leads to wildfires.

Urban areas are the major source of greenhouse gas emissions and should also take the role of global leaders in tackling climate change problems through greenhouse gas mitigation process. [5] The necessity of cities in opposing climate change has been reflected in international meetings and agreements, such as the Kyoto protocol which aims to lower greenhouse gas emissions, the Paris Agreement which consent on maintaining global warming less than 2°C above pre-industrial level, and also the United Nations Framework Convention on Climate Change.

Facing such natural disasters as the consequences of human activities, it is now essential and necessary to explore methods and policies on sustainable urban city building so that to adapt and retard, if possible, climate change, and to propose prevention strategies on natural disaster handling so that to develop urbanization globally.

The purpose of this research is to analyze the importance and necessity of planning and constructing sustainable cities, as well as to propose suggestions on urban protection strategies, as well as proving the necessity of such planning and strategies.

## 2. Discussion

The idea of sustainability has been dragged to the forefront of policymaking as the whole human society wakes up to start facing the consequences that the climate change has brought and will continuously be imposing on our cities and lifestyles.

The consequences that are threatening both human-built and natural systems existing in urban cities are mainly due to climate change and fossil fuel-based energy usage. [6, 7, 8] what makes situation even serious is that the threats are not only from climate change and energy usages themselves, but also administrative omission, rapid urbanization expansion, and socioeconomic crises are several obvious sources of uncertainties. [9, 10] Thus the necessity of developing a more effective and resilient planning and development perspective is becoming more and more urgent, so that it is possible to cope with the huge transformations that environments, cities and societies that have been going through in the last few decades. [11] To address these challenges and solve the problem of climate change and lack of sustainability, some experts around the globe regards the sustainable urban development as a feasible opportunity to form new mechanisms for creating a desirable and ideal urban future, with sustainability lie at the core. [12, 13, 14] Sustainable urban development is defined as the process of improving the urban life quality, which consists of aspects such as environmental, ecological, social, political, cultural and economic, without worsening the burden imposed on the future generations. [15, 16] Sustainability, in essence, is to presumes the resources being finite for the future generations to live an abundant life. Thus, in this way, sustainable urban cities are being successfully developed and formed.

Urban sustainability is becoming a more and more conspicuous debate topic in the twenty-first century, especially in urban policy making, urban design and planning, and global sustainable development decision making. In more recent years, sustainability shows a critical importance via the adverse impacts of society activities, for example climate change. In a society where the atmosphere is raising the awareness of the negative consequences thoughtless urban development decisions characterized by the neglect of sustainability, increasing efforts and considerations should be put into constructing future novel urban cities that could support long-term developmental goals of human societies. It is commonly, and at the meantime mistakenly, to regard technology as the panacea to all sorts of problems. However, answers to sustainable urban development problems should not only be sought by relying on technological availability only. Critical thinking and

introspection on the two sides of technologies should be active as it is more than clear that technological development and industrialization led to climate change in the twenty-first century. Though in urban planning and design, technology is frequently applied and it should not be denied that they realized their potentials in increasing efficiency and providing alternative solutions, rethinking of sustainable urban planning is always essential and should always be ahead of technology utilization.

The necessity to protect the environment from the ecological destruction as the measure to achieve sustainability is now a relative common consensus. Sustainable urban cities would be one of the best solutions since urban areas are taking increasing larger territory and exerting heavy ecological impacts, and at the meantime they also behave as the protection of economy which could be impeded due to the implementation of new policies to facilitate the transition to sustainable way of living. Unfortunately, sustainable cities construction in large urban areas are still not realized.

### 3. Suggestions

Without foreseeing too further into the future and discussing further on the topic of sustainability itself, the two most urgent aspects to consider are the ones mentioned in the Introduction section. Firstly, urban planning and development is not on the adequate track to follow the concept of sustainability with the aim of climate change adaptation and retardation.

#### 3.1. Sustainable Urban Planning for Climate Change Adaptation

Without foreseeing too further into the future and discussing further on the topic of sustainability itself, the two most urgent aspects to consider are the ones mentioned in the Introduction section. Firstly, urban planning and development is not on the adequate track to follow the concept of sustainability with the aim of climate change adaptation and retardation.

Recent climate change impacts and related catastrophic events around the globe raised the concern that whether government and societies have the ability to adapt to climate change or if the capacity is limited. Clear switch of scientific discussions have been captured, from the need of adaptation to methods of adaptation, and further to what obstacles are on the route of adaptive efforts being tried and made.

Discussions have been made around major barriers to be solved in order to make successful adaptation, and yet there isn't a universal and congruent answer. [17, 18] Some suggests barriers to be the obstacles that need to be overcome by means of accordant effort, flexible management, critical thinking and wise allocation of resources. Moser and Ekstrom [19] While it is without doubt that barriers will always emerge along the way of effort, and it is sufficient to agree that complete understanding of the nature of such barriers to adaptation would be difficult due to the fact that existing papers on such topic is highly situation-specific. This does not indicate that understanding the nature of barriers to adaptation is not worth doing. On the contrary, it is as essential as making sustainable urban planning policies itself since considerable new and unforeseeable barrier can emerge along the way of developing climate change adaptation policies and regulations. Predicting such barriers and problems and solving them in advance would be appreciative effort in terms of avoiding unintended consequences of new policy implementation.

Sustainable urban development could be referred to many social aspects, affecting various fields including population growth, agricultural transformation, energy usage, resource allocation, pollution management etc. All factors of sustainability are equally important. The development for a sustainable city implies setting goals that meet the needs of environmental, social and economic values. The developmental process and the related policy making along the way require changes being made constantly, depending on the varying situations and problems emerged. Modern planning of

sustainable cities with the goal of adapting to climate change should be dynamic, with initial goals and strategies clearly set.

Sustainable urban planning and building should be facilitated with the consideration of the amount of community participation, natural environment awareness, and most importantly, the engagement of governmental officials and public planners. Sustainable urban planning should regard the city or the urban region as a whole or as a system where various factors interact. This section proposes several factors, and effective implementation methods to achieve the purpose of sustainable city building and climate change adaptation.

### **3.2. Measures for Sustainable Urban Constructions**

#### **3.2.1. Recyclable Materials and Renewable Energy**

Wastes were once seen as the burden to societies, especially after the evolvement of urban cities and rapid urbanization. Compared to the roving era, wastes accumulate in cities rather than left behind. Problems arise from industrial wastes and household wastes, and eventually lead to diseases due to lack of hygiene, poor living conditions, and even large-scale epidemics. Landfills was adopted and even nowadays still a common method to cope with human wastes. However, avoid landfills and impose policies focusing on material recycle and clean energy usage is one of the most important criteria to build sustainable cities. Most of the wastes, like plastics, take decades to decompose in land and brings toxic chemicals into the land that eventually end up in urban water supplies. During the time of decomposition, undesirable chemicals constantly erode soil and harm agriculture; they take up land and space that could otherwise be used to create social and economic values; polluted water eventually permeates into industrial production, agricultural irrigation, and everyday drinking water. Such waste should be recycled instead of crudely buried underground to enter a new cycle of value production and at the same time avoid long-term harm. Renewable energy takes the same logic, as traditional energy like fossil fuels is disposable meaning constant supply of crude oil is necessary to support the functionality of cities, just like traditional materials (e.g. plastics) that ended up underground after being used. Shifting to renewable clean energy, -e.g. solar, biomass, hydro, geothermal, and wind, not only drastically reduces carbon emission from fossil fuel burning, but also solves the problem of finite storage of crude oil. Decent portion of governmental allocation of budget, human capital, resources, and policies should be transferred to the development of material recycle systems and renewable energy construction.

#### **3.2.2. Sustainable transport**

Transportation, as another important indicator suggesting functionality and sustainability of an urban area and city residents, should be designed as diverse, organized, and environmental-friendly, with a focus on the development of public transportations. To achieve sustainability, it is necessary for a city to be able to provide its citizens with various traffic patterns: walking, bike riding, cars, and public transportations. Diverse transportations ensure a society able to expand its functions, explore its potentials, and facilitates its citizens to achieve both short-term and long-term economic and financial goals. Also, optimum transportations allow citizens to live a life in a convenient way so that further assure desirable social interactions. Diverse transportations not only combine economic and social values together, but more importantly ensures the flexibility to making choice. Imagine a city with imbalanced transportations with public transportations weakly developed, citizens would be forced to choose commuting to workplace by car. Larger emission of greenhouse gases like carbon dioxide would be inevitable, compared to cities with mature and wisely organized public transportation system.

### 3.2.3. Resource and space allocation

It is necessary to distribute wisely and accordingly to each of the urban functions, in various parts of the city. Space should include all function needed for living, such as housing, education, medical care, works, recreation, and etc... Wise resource allocation is also to ensure all goals, factors, and policies made for building a sustainable urban areas would be able to achieve efficiently and without retardation.

### 3.3. Strategies for Disaster Protection

Secondly, prevention strategies and emergency preparedness are not mature in most of the countries and authorities when facing the consequences, - e.g. natural disasters such as typhoons and heavy rainfalls, of climate change. This section discusses such strategies and policies that are able to prevent the happening of disasters and also ensures the safety of cities and citizens within upon the arrival of unstoppable catastrophe.

Abnormal weather and natural disasters have become more frequent and serious around the world in recent years. Heavy rainfall and floods, fog and haze, wildfires and air pollution all impact urban systems and threatens people's life seriously and differently.

There are several important principles on disaster prevention strategies. Such strategies need to be quick and simultaneous in responding to the disaster, and it must show its capacity to be used easily by a lot of people in a relative short time, regardless of users' capability of language and physical conditions. Upon the arrival of natural disasters, it should reveal a complete stability in terms of its material and structures so that it could be assured that secondary damage is avoided after implementing the strategies. Finally, disaster prevention strategies and policies should be easily used for a long time and have its continuity, otherwise it should be updated regularly by officials, and at the same time educate the updated strategies to all citizens and city residents.

Strategies could be categorized into prevention, preparedness, response, and recovery. Prevention strategies is used to suppresses the occurrence of catastrophe by means of elimination or reduction the causes of disaster. Preparedness refers to planning, preparation, and their education and advertisement before actual disaster occurs so that capability to combat against the disasters are enhanced. Exercise, simulations, and modification should be implemented under this category. Response is a kind of design that helps to lower the impacts and damages of possible secondary disasters after the occurrence of natural catastrophe, by foreseeing, predicting, and wisely allocating existing resources and human capitals. Recovery refers to activities that recovers communities, social interactions, hygiene, and all relevant situations as before the disaster.

Table 1: Disaster Protection Strategy Categories and Respective Facility examples

Categories	Facilities
Prevention	Disaster Area Notice, Disaster Map, Safety Facilities, Investigation Equipment of Safety Degree
Preparedness	Evacuation Facilities, Refugee Camp, Disaster Simulations, Emergency Alarm System, Damage Investigation System
Response	Emergency Guide Facilities, Emergency Communication Equipment, Urgent Evacuation Shelter, Emergency Medical Supplies, Emergency Electric Equipment,

Table 1: (continued)

Recovery	Shelters, Supplies for Epidemics Prevention, Physical & Psychological Healing Program, Pollution Control
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#### 4. Conclusion

Human society development since the start of Industrial Revolution release large amount of population from the trap of poverty and hunger. Its contribution to economic growth and society prosperity should never be doubted, while unintended consequences and problems that arise from urbanization as well as along the way of industrialization also stands as the obstacles in long-term urban evolvement. To avoid exhaustion of potentials, sustainable urban planning and building is necessary to adapt to climate change, the disastrous effect of urbanization and industrialization. Meanwhile, it is also necessary to prepare strategies for disaster prevention so that there are methods on hand upon the arrival of natural disasters and prevention of loss could be achieved.

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