Chapter 3

Climate Change Risk Management Strategies: Resilient Cities

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Abstract

Cities with dense populations are the most affected by the negative impacts of human-induced global climate change. Increasing population density and urban population growth have led to increased anthropogenic activities in cities. As a result of this situation, urban risks and threats have started to increase.

The housing problem in cities, increasing factories, waste, and destruction of nature have led to an increase in the destructive effects of climate change. With the gradual depletion of resources, cities have become more fragile and vulnerable. Unconscious activities to meet consumption needs have started to harm the city, the environment, and people. When the source of the problem is examined, it is seen that a solution can be reached by durably designing cities. In this context, a comprehensive literature review has been conducted on the extent to which architecturally designed and implemented urban models are at the point of adapting to the fight against climate change. Carbon-neutral cities, smart cities, slow cities, ecological cities, compact cities, green cities, and resilient city models were analyzed. A wide range of literature has been provided on the cities where these urban models are applied and the benefits they provide in mitigating the effects of climate change. As a result of the study, it was concluded that resilient cities are an important preparation and capacity-building step that should be emphasized and developed in the climate change risk management process. It is agreed that resilient cities are an important adaptation process in reducing climate change and related disaster risks.

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1. Introduction

In the developing and transforming world, the change in the balance of supply and demand has become a problem. The activities carried out to meet the needs have caused destructive effects after a while. This destructiveness has manifested itself in different norms. Today, it has emerged as climate change. Climate change is not a concept encountered for the first time (Akbulut and Kaya, 2020; IPCC, 2007b) . Our planet has been exposed to climate change for various reasons in the past years. This exposure has occurred due to natural processes or natural disasters. With the beginning of the industrial revolution, the factors causing climate change have changed hands. The increase in carbon and other greenhouse gas emissions into the atmosphere, rapid population growth, unplanned urbanization, destruction of green areas, inability to manage waste, and the unstoppable increase in the use of fossil fuels have led the current situation to a crisis(Akbulut and Kaya, 2020; IPCC, 2007b; Türkeş, 2008).

Climate change has had serious impacts on the basic structures that sustain societies in recent years. It has started to cause concern for economic and social sustainability (Marshall et al., 2013; Yu et al., 2013). When we look at the past periods, we can say that climate has always maintained its importance for humanity by going through different changes and transformations throughout history; it is known that the change experienced in the current situation is different (Adger et al., 2009). This situation, characterized by human-induced climate change, is accepted by almost all public opinion. The human-induced climate crisis is a problem that needs to be solved urgently due to its emerging effects. When we look at the disasters experienced in the world in recent years, we see that ninety percent of them are climate-related. The problems caused by climate change are certain to affect future generations if no measures are taken (Lee and Romero, 2023; Türkeş, 2008). A solution to a human-induced problem will only be produced with the efforts of human beings. Therefore, studies are carried out in various fields in combating climate change. The policy of creating cities resistant to climate change is at the forefront of these efforts. The fact that cities have a very dense population and the expectation that the rural population will decrease in the coming years has led to the concept of resilient cities (IPCC, 2021). With the increase in industrial activities to meet the needs of the dense population in cities, carbon emissions have reached maximum levels (Uttara et all., 2012; Satterthwaite, 2007; IPCC, 2021). Therefore, it has become important to reduce the vulnerability of cities to this increasing problem in cities. We can only break this vulnerability by making cities resilient. Resilient cities are cities where the hazards and risks potentially harming

society are analyzed in advance, and the environment, infrastructure, and society are designed accordingly. When we look at the general characteristics of cities that can resist climate change, we see that they focus on important topics such as energy efficiency, green management, waste management, zero carbon emission, and infrastructure (Beatley, 2000). Resilient cities are not just a defense mechanism. They also aim to develop the capacity of cities (Ministry of Environment, Urban Development and Climate Change, 2016). In other words, a resilient city created by fulfilling all norms in a complete manner will also have made significant gains on the road to development.

This research is based on the studies conducted in the process of climate change risk management and the role of local governments in this regard. In the research process, how the arrangements have been made in the cities, which have an important share in increasing the negative effects of climate change, and how scientific fields such as architecture have approached the issue have been studied. In this respect, the study is multidisciplinary research. As a result of the literature review, the importance of the concept of resilient cities against climate change was mentioned. A compilation that will contribute to the literature has been revealed through resilient city models and examples. Important conclusions have been reached that the study is open to improvement and will benefit future generations.

2. Conceptual Framework of Climate Change

2.1. Definition and Causes of Climate Change

Changes in temperature, precipitation, humidity, wind, and climate-related extreme events in a region over a certain period are called climate change. A number of statistical tests need to be used to determine climate change. In addition, long-term measurements are needed to discuss climate change in a region. Climate change is an essential issue due to the problems it causes. The world has been exposed to this change from the past to the present. Two parameters cause climate change (Ahrens and Henson, 1994; Türkeş, 2008). These are natural and human-induced causes. Natural-induced climate change is generally caused by the Earth's natural processes (sunspots, axis tilt, plate movements, milankovic cycle, volcano eruptions, etc.) (Türkeş, 2008). On the other hand, human-induced climate change is caused by increased production activities with the millennium age and the destruction of nature by human hands with the addition of technological developments. The most important human-induced causes are increased greenhouse gas emissions, increased carbon footprint, rapid population

growth, unplanned urbanization, destruction of nature, and lack of waste management (IPCC, 2014; IPCC, 2007b). These causes have not decreased today. Governments are working on the issue, but greenhouse gas emissions have not been reduced. In this case, it again harms people and the ecosystem. The problems caused by global climate change are detailed under the heading below (Akbulut and Kaya, 2020).

2.2. Negative Consequences of Climate Change

The problems caused by the climate crisis and the extent of the damage it is causing to people and society, which is increasing day by day, are as follows:

- Abnormal increase in global average surface temperatures
- Renewal of the record for the hottest year every year
- Increasing global average sea water level
- Ocean ecosystems face extinction as oceans warm and acidify due to rising temperatures and carbon emissions.
- The onset of unstoppable glacier melting in regions such as the Arctic and Antarctica, which are important climate parameters
- Declining sea ice levels
- Food and water crisis looms (WMO, 2022; IFRC, 2022).
- Damage to agricultural areas and agricultural production
- Large forests and green areas are disappearing
- Increasing number of hydrological and meteorological disasters due to climate change
- Displacement of people as a result of adverse conditions caused by climate
- Increase in infectious diseases
- Vulnerability and damage of cities to climate change (Kaya and Akbulut, 2021; WMO, 2022; IFRC, 2022).

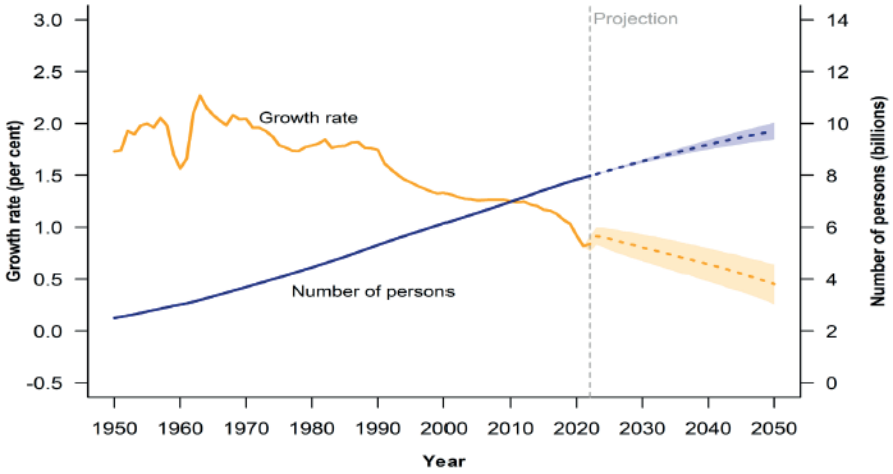
According to the results of research on the possible effects of climate change in the future, it is stated that this situation will continue more severely in the next century if no measures are taken, drought will increase, biodiversity will be damaged, and the world will be irreversibly damaged. In order to prevent this situation, making our society and cities more climate

resilient is an important risk management step (Varol and Kırıkkaya, 2017; Torabi, 2017).

3. Resilient Cities in the Scope of Climate Change Risk Management Strategies

With the rapid expansion of cities, the destruction of natural environments is also increasing. With the increasing urban population, industrial activities, unplanned urbanization, deforestation, and the carbon footprint are also increasing to meet the needs. This situation has made cities responsible for the factors that cause climate change. Published reports have shown that the amount of greenhouse gases emitted from cities is responsible for 70% of the total amount of greenhouse gases emitted (United Nations, 2022, United Nations Habitat-World Cities Report, 2016).

Figure 1. World Population Growth Graph and Future Forecast



Source: United Nations, 2022

Today, the world's population is three times larger than in the mid-twentieth century. Most of this increase is concentrated in cities. Looking at future projections, this increase is expected to rise to about 8.5 billion in 2030 and then increase by another 1.18 billion in the next two decades, reaching 9.7 billion in 2050. The fact that world population growth will continue in the future means that activities related to human needs will continue. Studies show that this increase will be concentrated mostly in urban areas. The increasing urban population will increase carbon emissions and environmental destruction if no measures are taken. Even the graph in Figure 1 shows that urban crises will increase; in parallel, we will feel the

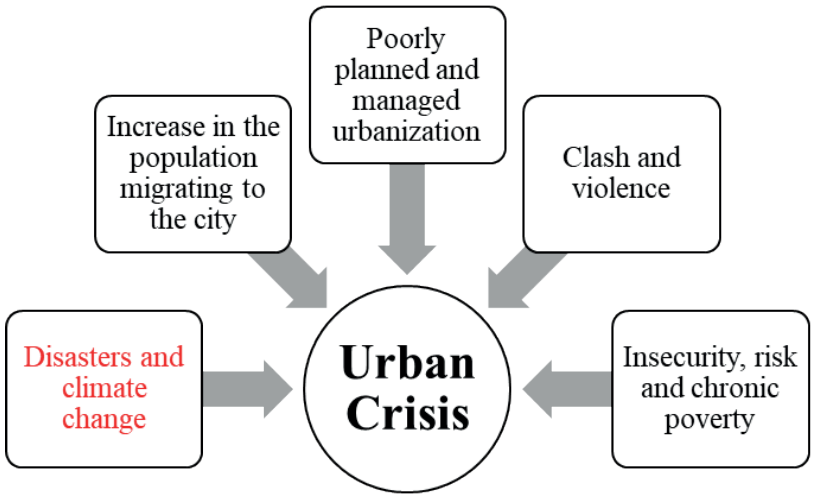
effects of the climate crisis more (United Nations, 2022). Therefore, the importance of urban studies is better understood at this point. Measures to be taken against the increasing urban population and implementing environmentally friendly urban models will help reduce the factors that cause climate change.

This link between climate change and cities has been recognized on international platforms, and it has been concluded that urban improvements will effectively solve the problem. Cities where the factors causing climate change are reduced have started to be designed. Climate-resilient city models have emerged by designing cities with energy efficiency, infrastructure arrangements, ecological approaches, and minimizing carbon emissions. This attempt will help reduce cities' negative impacts on climate change (Dieleman and Wegener, 2004; Tuğaç, 2018).

3.1. Reasons pushing cities to be prepared

With changing living conditions, taking precautions has become effective in all areas of life. In cases where individual efforts are insufficient, this effort may need to be local, regional, or even international. The preparedness of cities against crises will make them resilient in the face of dangerous situations (Peker and Aydın, 2019; Irmak and Çelenk Kaya, 2023). When we look at the events experienced, it is seen that urban losses have increased in some disasters, which has shown that cities need to be prepared. The reasons that push cities to be prepared are shown in Figure 2 below.

Figure 2. Reasons pushing cities to be prepared



Source: Brown et all. 2015

As seen from the above explanation and the figure above, certain issues cause crises in cities. The city must be prepared for these problems. A city with a high level of vulnerability may suffer many losses when these crises occur and may even come to the brink of extinction. Therefore, it has become one of the most important issues to ensure that cities achieve a more flexible and resilient structure to reduce urban fragility. One of the most important crises affecting cities is global climate change and related disasters, the effects of which have been increasing in recent years. Due to cities' chaos, density, and industrial activities, carbon dioxide is constantly emitted. As these increasing emissions bring about the climate crisis, a safety gap is created in cities. This security problem can be eliminated by making cities healthier with the preparations made (Brown et all., 2015).

3.2. Situations Cities Need to Be Prepared for

It is not possible to talk about risk where there is no human factor. With the emergence of human vulnerability, risks reach the level of a problem that must be eliminated. In other words, human beings are a phenomenon at the root of the crisis. As can be understood from this explanation, cities with a dense human population bring along situations that need to be prepared. These situations are as follows:

- Crises arising from human rights and freedoms
- Population mobility and related urbanization problems,
- Crime and security issues,
- Problems arising from insufficient labor force and employment,
- Health issues and biological disasters
- Man-made disasters
- Natural disasters
- Global climate change (Najafnezhad et all., 2019; Tekin, 2023).

Considering the above-mentioned urban problem titles, it is clear that human beings are at the root of the problems. In addition, disasters and climate change are other problems that often create problems in cities (Najafnezhad et all., 2019; Tekin, 2023). Therefore, we can say that the essence of the work to be done is to change human behavior and raise awareness. As a second step, the strategic steps and policies to be developed by the city administration are another factor that will be involved in the process of solving urban problems (Çelenk Kaya and Irmak, 2023).

3.3. How to Become a Resilient City Against the Impacts of Climate Change?

It would be wrong to say that a single phenomenon can create climate-resilient urban culture. We can build resilient cities through the joint efforts of the city administration and society. However, a road map is needed in this regard. On the way to becoming a resilient city, cities should first make adjustments in infrastructure and environmental policies. Topics such as zero waste, air, water, soil quality, transition to alternative energy sources, and encouraging industrial and domestic production are important environmental policies that need to be made to become a resilient city. Improvements in sewerage, wastewater, sustainable transportation, the protection of green areas, and effective land use are important topics in infrastructure policies (Ministry of Environment, Urban Development and Climate Change, 2016). In addition, within the scope of resilience efforts in the city, local governments should primarily aim for less carbon emissions against climate change. For this, they should focus on the following three main topics:

- Promotion of energy efficiency,
- Scaling up clean and renewable energy,
- Identifying sustainable environment and infrastructure policies (Ministry of Environment, Urban Development and Climate Change, 2016)

In the paragraph above, it is stated that the process of creating a climate-resilient city is not possible with the administration alone. Therefore, as a society, we should make the necessary efforts to gain climate change awareness, protect green spaces, use public transportation or bicycles, pay attention to recycling, and reduce our carbon footprint (Ministry of Environment, Urban Development and Climate Change, 2016).

3.4. Carbon Neutral City

Carbon is an important element that plays a role in forming the basis of compounds. Found in various forms, such as solid, liquid, and gas in nature, carbon has an important role in the continuity of life. Carbon is a basic building block found in many chemical compounds. One of these chemical compounds is CO2 gas in the atmosphere. As long as this gas is present in the atmosphere at a certain rate, it does not pose any problem for the ecosystem; however, the excess carbon released into the atmosphere with the Industrial Revolution disrupted this structure after a while, and the concept called greenhouse gas emerged. Excess carbon in the atmosphere and

other greenhouse gases trap the sun's rays and prevent them from reflecting back on the Earth. This causes the Earth to heat up more than normal and causes the greenhouse effect (Sınmaz, 2013; Jia, 2009).. Carbon is not only caused by the industrial sector. It also causes carbon to be released into the atmosphere in human activities. Cars used by people, cosmetic products, waste, heating, etc. The atmosphere emits carbon to a certain extent due to their needs. The carbon emissions that individuals are responsible for create their carbon footprint. Increasing carbon emissions cause climate change and related disasters to increase, disruptions in the ecosystem, and adversely affect the lives of humans and other living things. The right steps against climate change help reduce the risks before such negative situations arise. The concept of Carbon Neutral City is an important risk management preparation in order to combat climate change (Sınmaz, 2013; Jia, 2009; Bongardt et all., 2002).

Carbon-neutral cities aim to reduce carbon emissions in cities through joint efforts with the participation of local governments, civil society organizations, and the public. In this context, they change their policies if necessary, and the administration effectively develops strategies to reduce carbon emissions. The characteristics of carbon-neutral cities are as follows:

- Reducing carbon footprint,
- Reducing urban density,
- Reducing societal vulnerability to climate change,
- Reducing carbon emissions by 80% by the end of the year or earlier,
- Ensuring transition to renewable energy sources,
- Conducting studies on energy efficiency,
- Efficient use of land (Sınmaz, 2013; Jia, 2009),
- Making the transportation sector environmentally friendly,
- Raising awareness on climate change,
- Leaving a better future for future generations by ensuring sustainability in environmental issues (Sınmaz, 2013; Jia, 2009).

Looking at the characteristics of carbon-neutral cities, it is evident that they include important steps to reduce the effects of climate change. Carbon-neutral cities against climate change are also important for sustainability development (Sınmaz, 2013; Jia, 2009; ; Bongardt et all., 2002). Thanks to such a city model, the effects of climate change and the disasters it will cause will be reduced, and cities will become climate-resilient.

3.4.1. Carbon Neutral City Example - Copenhagen, Denmark

In this city, where studies have been carried out on carbon emissions, which are considered among the most important causes of climate change, the right steps have been taken, and the results have started to be achieved. Copenhagen, which reduced its current carbon emissions by 40% from 2005 to 2005, has established sanctions aiming to reduce carbon emissions to zero in the coming years. The city aims to reach a zero-carbon level in 2050. In this context, the city is taking firm steps towards becoming a carbon-neutral city by taking reformative steps in many areas, such as reducing the use of gasoline and diesel vehicles, switching to fully electric vehicles by 2030, switching to renewable energy sources such as wind energy, solar energy, etc., encouraging the use of bicycles and organizing traffic accordingly and protecting green areas (*www.ecobuild.com.tr*, 2024).

3.5. Resilient City

Being resilient in cities aims to make cities more robust, flexible, and resilient while adapting to change without failing in the face of disasters. Although the concept of resilient cities has come to the agenda, especially after the devastating effects of climate change started to emerge, it is more comprehensive in terms of content. It is an urban management approach that aims to increase social resilience against natural disasters (earthquakes, floods, landslides, etc.) and man-made disasters (wars, industrial accidents, etc.). Increasing urban resilience is possible through new strategies adopted in governance and policies that support it (Öztürk and Demirel, 2021; Sınmaz, 2013). As a form of urban risk management, resilient cities are an important risk management preparation that can be applied in the risk management process against the negative impacts of climate change. The general characteristics of resilient cities are as follows:

- Increasing urban resilience in the long term,
- Ensuring social awareness against disasters,
- Being environmentally, socially, and economically sustainable,
- Strengthening infrastructure,
- Ensuring that the administration makes the city prepared for disasters and emergencies within the plans,
- Ensuring the city's resilience and long-term adaptation to shock and stress,
- Reducing fragility (Öztürk and Demirel, 2021; Sınmaz, 2013),

- Reducing the factors that cause climate change and ensuring preparedness to combat these impacts .

3.5.1. Resilient City Example - Montreal, Canada

Montreal, the second largest city in Canada, is among the 100 resilient cities in the world. There have been a number of circumstances that pushed the city to become resilient. Montreal has been exposed to many natural and man-made disasters over the years, and as a result of the damage it has suffered, it was decided to restructure the city. All hazards and risks threatening the city and its citizens were identified, and then the Montreal Resilient City Strategy was prepared. In this context, floods, storms, extreme snowfalls, earthquakes, and terrorist attacks were identified as sudden and shocking situations for the city. Climate change, infrastructure and superstructure problems, traffic problems, poverty, and security problems are also identified as creating pressure and stress for the city. A work schedule has been planned and implemented for the four main orientations and twelve objectives set out in the Montreal City Strategy. Montreal is taking the necessary steps to become a resilient city through individual and social measures and continues its development (Öztürk and Demirel, 2021).

3.6. Compact City

Although there are differences of opinion on how this urban form makes cities resilient to the negative impacts of climate change, in general, it reduces the impacts that cause urban climate change in terms of some of the new urban forms it brings. Compact cities are an anti-sprawl urban model. It aims to concentrate cities in a certain area and use land more efficiently. A sprawl of cities is a contrary approach to understanding this urban type. The basic logic of this approach is that sprawling cities have negative social and environmental impacts. When compact cities are considered in terms of controlling the city, population, and transportation, it is seen that they eliminate a number of factors that cause climate change (Mikaeili and Memlük, 2013; Neuman, 2005). It can be said that compact cities fall within this scope in terms of creating a city resistant to climate change. The general characteristics of compact cities are as follows:

- Reduced land use, protecting agricultural and rural areas,
- It advocates alternative methods such as public transportation, bicycles, and walking paths instead of people using cars individually. This reduces carbon emissions and air pollution,

- It supports biodiversity and provides recreational spaces for city dwellers,
- Climate compact cities make cities more resilient by increasing their ability to cope with natural disasters (Mikaeili and Memlük, 2013; Neuman, 2005).

3.6.1. Compact City Example - Melbourne, Australia

As the second largest city in Australia, Melbourne is also one of the most densely populated cities in the country. In the past years, the city went through a period of decline due to population growth and irregular urbanization, which the compact city model overcame. The rating agency The Economist Intelligence Unit named it the world's most liveable city seven times between 2011 and 2017. Managing the increasing population density and designing the city with compact city criteria in mind has helped Melbourne reach this level. This has resulted in more efficient use of land, shorter distances, energy-efficient housing, and a city system that is better able to respond to climate change. The city is expected to continue to set an example regarding sustainability in the coming years (Pınarcıoğlu and Kanbak, 2020).

3.7. Slow City

It is seen that the technology and standards developed to meet the needs of the consumer society have disrupted the structure of cities. Our way of life, which has become faster with technology, has brought along a number of problems. In contrast to these new standards that cause environmental and cultural degradation, a new urban movement has emerged. This movement, the Slow City, carried out a protection task against the deterioration of cities' natural and cultural texture. The main goal of the slow city movement is to preserve the local characteristics of a region and standardize the lifestyle. The slow city movement includes more than 50 criteria. It is a movement based on the basic cultural structure of the local region, environmental policies, infrastructure policies, urban fabric quality, local production, and awareness parameters that settlements with a population of 50000 and below can participate in. By preserving the natural beauties, historical and cultural richness, and calm texture of the places that have become slow cities, these regions are also open to tourism (Günerhan et all., 2010; *www.cittaslow.org*, 2024; Sınmaz, 2013)

Slow cities have important criteria such as reducing noise pollution, protecting green areas, reducing traffic, and supporting agricultural

production on the way to becoming a city resistant to climate change. In this regard, the prominent features of slow cities in the fight against climate change are as follows:

- Encouraging waste management and alternative energy sources,
- Prevention of noise, light, and air pollution,
- Reducing the use of fossil fuels and minimizing carbon emissions by encouraging pedestrian, bicycle, and public transportation,
- Ensuring the protection of green infrastructure and natural areas,
- Raising social awareness

Within the scope of combating climate change, it reveals an approach to creating a city that adopts a simpler lifestyle and reduces the factors that cause climate change (Günerhan et all., 2010; *www.cittaslow.org,* 2024; Sınmaz, 2013).

3.7.1. Slow City Example - Chianti, Italy

In this city of Italy, which has the criteria to become a slow city, studies have been carried out under seven main headings such as environment, infrastructure, (urban life, social cohesion, policies on agricultural-touristic-craftsmen and artisans, hospitality-awareness, and education plans. Chianti is the world's first slow city. In this city, where the natural texture is preserved, there is a structure contrary to a uniform urban order. Green areas are preserved, carbon emissions and carbon footprint are minimized, vehicle traffic is very low, and energy efficiency is high (*www.italyaonline.net,* 2024).

3.8. Smart City

The world population distribution shows that half of it lives in cities. Projections of future population growth show that the urban population is likely to increase even more by the end of the century. Managing the growing population and ensuring that the capacity of cities can respond to this increase requires an urgent solution. In order to manage growing populations and expanding cities, policies, visions, and strategic approaches are needed. Smart cities are an urban approach model developed to respond to this. When we look at the secondary crises that rapid population growth and urbanization will bring, we see that crises cause climate change, such as carbon emissions and increase in carbon footprint, excessive use of resources, and destruction of green areas. Smart cities, which are a step towards sustainability goals, fight the factors that cause climate change in cities with the solutions they will bring. Thanks to smart cities, resources

are used effectively, and carbon emissions are reduced. Smart cities contain important principles on issues such as infrastructure development, social participation, and efficiency (Kayapınar, 2017; Leroy, 2002). In this context, the prominent features of smart cities in combating climate change are as follows:

- Ensuring the management of disasters and emergencies,
- Building smart infrastructure,
- Effective use of geographic information systems,
- Using applications such as public transportation and car sharing and implementing applications that reduce traffic congestion
- Use of clean and alternative energy sources
- Ensuring waste management
- Designing buildings to save electricity, water, and energy,
- Adopting a smart city style in the context of combating climate change provides an approach to creating a city that reduces the factors that cause climate change (Kayapınar, 2017; Leroy, 2002).

3.8.1. Smart City Example - Songdo, South Korea

The city is located 65 kilometers from Seoul, the capital of South Korea. The entire system is based on a technological infrastructure. This system, which utilizes smart buildings and systems, also has exemplary practices to mitigate the effects of climate change. For example, they have remarkable features such as smart transportation systems, smart water management, energy efficiency, smart lighting, waste management, and smart city infrastructure (Kayapınar, 2017).

3.9. Ecological City

The ecosystem is an inseparable whole with all the living organisms and the air, soil, water, and sunlight with which they interact. A break in any part of this whole affects the other parts like a domino effect. Climate change is the climate crisis that is increasingly damaging this structure. The ecological city approach developed to prevent this situation, which destroys the ecosystem with the effects it causes, is among the solutions. This urban model, which protects nature and aims to protect the health of the ecosystem within the scope of environmental sustainability, is a balanced and livable urban model (Suzuki, 2010; Sınmaz, 2013; Çetinkaya, 2013; Bongardt et

all., 2002). The approaches it brings in terms of reducing the effects of climate change are as follows:

- Minimizing the damage to nature by ensuring the recycling of waste,
- Encouraging the use of renewable energy sources,
- Preventing human destruction of nature,
- Protecting and increasing the number of green areas,
- Reducing the amount of carbon emitted into the atmosphere by expanding the use of public transportation, pedestrian paths, and bicycle paths,
- Consolidation of infrastructure,
- Water management,
- Reducing carbon footprint
- Ecological cities improve the quality of life of city dwellers. They protect natural resources. It supports biodiversity and creates an approach to creating a city where climate-causing factors are reduced by adopting an ecological city style within the scope of combating climate change (Suzuki, 2010; Sınmaz, 2013; Çetinkaya, 2013).

3.9.1. Ecological City Example - Zurich, Switzerland

Zurich, one of the most important cities in Switzerland, was recognized as the most sustainable city in the world in 2016. As a pioneer in an ecological city with its studies, this city has important studies in terms of urban risk management to mitigate the factors causing climate change. It is a pioneering ecological city that combats climate change with important policies such as reducing carbon emissions, improving air quality, protecting water quality and biodiversity, transportation, and spatial planning (*www.cityhealthj.org,* 2024).

3.10. Green Cities

The purpose of green cities is to provide clean air and clean water, to be resilient against natural and man-made disasters, and to adopt a green approach in terms of management and behavior. Green cities prefer environmentally friendly practices as an approach. They strive to reduce the impacts that cause damage to the environment. In this context, we can say that green cities are a city model developed to reduce the effects of climate

change and create a healthy, sustainable environment (EGC, 2001; Bongardt et all., 2002). The general characteristics of green cities are as follows:

- Adoption of a green management approach at the local level,
- Preventing environmental pollution by ensuring waste management,
- Promoting green businesses,
- Using renewable energy sources,
- Reducing the use of fossil fuels,
- Raising ecological awareness,
- Adopting green urbanism in the context of combating climate change is an approach to creating a city that reduces the factors that cause climate change.

3.10.1. Green City Example - Vienna, Austria

In this city where nature and the city are intertwined, there are almost 120 meters of green space per person. Vienna is almost unique in the world in this respect. Even though green areas are intertwined with the city, they are protected with great care as awareness of green protection is high in society. In addition, the city's local government is carrying out important activities to combat climate change, such as waste management, heating with energy obtained from waste, using alternative energy sources, and decarbonizing buildings. As seen in the example of this city, administrative and social contributions should be made to adapt to climate change (*www.ekoiq.com,* 2024).

4. Conclusion and Suggestions

This study examined resilient cities in detail within the scope of climate change risk management. Within the scope of the study, explanations have been made about the concepts of climate change and risk management, and information has been given about the concepts of carbon-neutral city, compact city, slow city, smart city, eco-city, and green city in terms of risk management strategies. The possible effects of these concepts, which are given importance within the scope of climate change risk management, are mentioned.

Climate change is a serious problem in today's world and a source of concern for individuals. Climate change, which includes many factors such as increasing temperatures, unexpected weather events, and rising sea levels, negatively impacts individuals and is seen as an important pressure factor

on states, governments, societies, and the business world. Climate change makes it necessary for all organizations, especially states, to focus on risk management.

When examined in terms of climate change risk management, it covers determining past, present, and possible future climate change impacts, plans to cope with them, and developing long-term sustainability strategies. Increasing the resilience of organizations and minimizing environmental impacts in the risk management process, which includes strategy and the determination of practices and methods, can help both public and private sector organizations maintain their financial and operational success because organizations cannot sustain their activities unless there is an environment and climate to live in.

The components of climate change risk management provide a framework for mitigating the impacts of climate change. First, risk assessment by relevant organizations is considered important in understanding the impacts of climate change. In addition, it benefits organizations and the environment by identifying threats and opportunities. On the other hand, developing adaptation strategies helps to create strategies for the risks identified and to become more resilient. A transparent communication process that embraces stakeholder relations makes risk management a safer process in which responsibilities are fulfilled. Using the latest technologies in this process may have the potential to make risk management easier. Fighting against climate change is only possible with renewable energy and sustainable means, which are considered weapons of defense against it.

While the risk management process in climate change is generally carried out within the framework of strategy formulation and implementation, it is argued that one of the ways to be ready for risks is to create resilient cities. Since the basis of climate change is the increase in temperature, variability of weather events, and disruption of normal life, cities are negatively affected by these events. However, if resilient cities are created, the fight against climate change factors can be carried out more effectively and efficiently. Resilient cities are an important element that fulfills resistance to negative changes and the construction of a sustainable future.

Regarding resilient cities, the most important issue for general and local governments is infrastructure. One of the most important factors for individuals to live in prosperity against climate change and expected climate events, and for businesses not to have difficulties fulfilling their activities is the healthy infrastructure in cities. On the other hand, raising awareness of society on this issue and creating communication and management strategies

in emergency processes creates resilient cities and resilient individuals. In addition, using sustainable and renewable energy tools, which is one of the climate change strategies, and investing in green technologies can increase resilience in the long term.

There are certain elements of progress toward becoming a resilient city: neutral city, compact city, slow city, smart city, eco-city, and green city. The concept of a neutral city is a city model that follows the strategies of reducing carbon emissions, ensuring energy efficiency, and using renewable energy sources. The neutral city, which includes efforts to be prepared for unexpected situations, strengthens sustainability and social resilience on the way to becoming a resilient city. The compact city, on the other hand, is one of the approaches frequently brought to the agenda in the search for sustainable urban development, and it aims to prevent economic, social, and environmental problems caused by urban sprawl. A compact city is defined as an increasing density of buildings and population and intensifying urban economic, social, and cultural activities in the search for environmental, social, and global sustainability resulting from the concentration of urban functions (Burgess, 2000). Compact cities aim to reduce environmental impact and be resilient to climate change by narrowing settlements and ensuring efficient use of resources.

The slow city, one of the resilient cities, is an approach that prioritizes peace and tranquility, aims to preserve local cultures and strengthen interpersonal bonds, and contributes to climate change strategies by offering an alternative model to consumption, technology, and fast city approaches. Since slow cities are not dense in many respects, it can be said that they are an important model in combating climate change. Smart cities, which can be expressed as the opposite of slow cities, aim to offer sustainable living spaces thanks to technology (internet of things, sensors, etc.), energy efficiency, security services, and many other elements. Eco-cities and green cities, on the other hand, aim to create and sustain natural ecosystems through the protection of green areas, zero waste management, energy saving, urban planning, natural habitats, and natural ecosystems within the scope of resilient cities.

This study provides a framework for the creation and long-term sustainability of resilient cities, which is an important factor in the climate change risk management process. It is possible to say that this study, which provides information on preparing cities in a more sustainable and resilient way, contributes to the accumulation of knowledge in the literature and reveals a new perspective. It is important to determine appropriate city

options according to the texture and conditions of the society and cities we live in and to contribute to the process by raising awareness of the society. Globally, resilient cities offer important elements for a healthy and balanced life. The common feature of all climate-resilient cities is to leave a more livable world for future generations. In order to protect against the impacts of climate change and related disasters, strategic approaches and policies related to resilient cities should continue to be developed, and the number of climate-resilient cities should continue to increase. Resilient cities are considered an important adaptation process in reducing the risks of climate change and related disasters.

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