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The Resilience of Sustainable Climate-Sensitive Cities in the COVID-19 Pandemic

Sürdürülebilir İklim Duyarlı Kentlerin Pandemideki Dirençlilikleri

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ABSTRACT

Cities that are the nodal points of global networks have been hit hardest by The COVID-19 pandemic. Cities are also one of the most significant actors in fighting against the climate crisis, which is similar to the effects of the crisis created by the pandemic and carries even more devastating risks. Therefore, it is crucial for them to implement sustainability policies to increase their resilience against these risks and combat the climate crisis. In implementing sustainability policies, many global networks offer various supports to both global climate-sensitive policies and city governments. In this study, the “urban sustainability and urban resilience” dimensions were discussed on the socio-spatial structure of cities during the pandemic, and inferences were made regarding the resilience and sustainability of the cities according to their sizes during the pandemic process. Cities were selected from five different countries which have different government types and are members of three different global sustainability networks. The study contributes to the literature by showing whether efficiently applied sustainability policies of a global sustainability membership matter for different-sized cities in increasing their resilience or not. It is found that the sustainability and resilience targets determined by the global urban networks are not applied in the cities participating in these networks, under the risk conditions created by the pandemic. In addition, many member cities do not sufficiently consider the “social dimension” in their sustainability and resilience policies such as health systems. It is surprising to see their insufficiency socio-spatial injustice and vulnerability in disaster periods.

Keywords: COVID-19, Urban sustainability, Urban Resilience

ÖZ

Bir küresel kriz olarak nitelendirilebilen COVID-19 pandemisi, küresel ağların düğüm noktaları olan kentlerde daha çok görülmektedir. Bu sebeple kentler, pandemi ile mücadelede en önemli aktör olarak öne çıkmaktadır. Pandeminin yaratmış olduğu krizin etkilerine benzer nitelikte olan ve hatta daha yıkıcı riskleri taşıyan iklim krizi ile mücadelede de kentler, en önemli role sahip aktörlerden biridir. Dolayısıyla kentlerin, bu riskler karşısında dirençliliğini artırabilmesi ve iklim krizi ile mücadele edebilmesi için sürdürülebilirlik politikalarını uygulamaları önem taşımaktadır. Sürdürülebilirlik politikalarının uygulanması hususunda birçok küresel ağ, hem küresel iklim politikalarına hem de kent yönetimlerine çeşitli destekler sunmaktadır. Bu çalışmada, pandemi ile birlikte kentlerin sosyo-mekânsal yapısına yönelik tartışmaların, “kentsel sürdürülebilirlik ve kentsel dirençlilik” boyutları ele alınarak, üç farklı küresel sürdürülebilirlik ağlarının üçüne de üye olan, farklı yönetim biçimlerine sahip 5 ülkeden seçilen, farklı ölçeklerdeki kentlerin pandemi sürecindeki dirençliliğine ve sürdürülebilirliği değerlendirilmiştir. Çalışmada küresel kentsel ağların belirlediği sürdürülebilirlik ve dirençlilik hedeflerinin, pandeminin yarattığı koşullar altında seçilen kentlerde yeterince bağlayıcı olmadığı tespit edilmiştir. Bu bağlamda birçok kentin sürdürülebilirlik ve dirençlilik politikalarında “sosyal boyutu” yeterince dikkate almadığı, birçok kentte sağlık sistemlerinin hala yetersiz olduğu ve sosyo-mekânsal adaletsizliğin afet dönemlerinde kırılganlığı artırdığı bu çalışmanın temel sonuçlarından bazılarıdır.

Anahtar kelimeler: COVID-19, kentsel dirençlilik, kentsel sürdürülebilirlik

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INTRODUCTION

When the number of COVID-19 cases increased and mutation viruses became widespread, discussions criticizing the policies that restrict “spatial mobility” came to the fore. In these discussions, it is emphasized that urban resilience is weak, and it is imperative to increase the resilience of cities in the post-pandemic period. The issues that came to the fore when the restrictions were lifted and the gradual/unstaged opening processes started are as follows: the need for green and open spaces, concerns about public transport use, density in common areas, revitalizing economic activity, and increase the sustainability of cities in to struggle for the climate crisis, which is another global problem (Jasiński, 2022).

As we look at the international solution proposals regarding sustainability and resilience, the 11th objective among the Sustainable Development Goals (SDGs) was defined as “Creating Sustainable Cities and Communities” and under this heading, it was emphasized that cities and human settlements should be made inclusive, safe, resilient, and sustainable (Croese et al., 2020). It is possible to examine the objectives determined under these objectives under four headings: *Ensuring everyone’s access to basic services, eliminating social inequalities, reducing the effects of climate change, and developing urban policies compatible with nature* (Shen et al., 2011: 19). The indicators determined for these purposes are as follows (UNSTATS, 2020): *urban poverty, disaster-affected, and disaster-related deaths, urban climate data, and risk reduction policies*. With the data obtained from these indicators, evaluations can be made about whether a country or a city is sustainable or not.

To measure the resilience of a city, some features of the city and its capacity to develop, improve, and provide flexibility against risks are evaluated (Zabanioutou, 2020: 18). On resilience, the UN Disaster Risk Reduction III. World Conference, commitments were made to create more resilient cities with the Sendai Framework for Disaster Risk Reduction. In the document, the scope of disaster risk is discussed as environmental, technological, and biological disasters, hazards, and risks that occur because of natural and human activities (Kelman, 2015: 121). From the point of view of the holistic approach of the Sendai Framework Convention, epidemics can be evaluated under the category of biological disasters. To qualify a disease as a disaster, the number of cases, the rate of transmission, and the high rate of death caused by the disease are considered. Therefore, the diseases and deaths caused by the COVID-19 virus make it possible to qualify this virus as a disaster (Özden, 2020: 27).

In this study, the cities with varying sizes that undertake to implement the principles of urban sustainability and create policies for this are examined to measure whether their sustainability and resilience to pandemic conditions are better or not. The cities examined within the scope of the study were selected from the cities that are members of ICLEI, C40 Cities, and GCoM organizations that aim to achieve urban sustainability goals and establish a dynamic network between cities. The main reason for choosing these three global organizations is that they establish ties with cities from different regions and adopt principles such as low emissions, resilience, and fair transition among their targets. While selecting a country that is a member of all three of these global networks we put emphasis firstly on the government type difference and secondly on size difference between cities. By paying attention to the different sizes of the selected cities, the importance of the scale in terms of sustainability-pandemic-resilience will be compared. Lastly, the relationship between sustainability and resilience in the pandemic process of the cities will be revealed by examining their local struggle process that varies according to countries’ governmental differences in type.

LITERATURE REVIEW

Urban Sustainability, Urban Resilience and the Pandemic

56% of the world’s population lives in cities; this rate is predicted to increase to 68% by 2050 (UN, 2020). It is known that cities are open to extreme weather events, heat waves, and the effects of changing precipitation regimes, both with their populations and built environments, because of the climate crisis (Uncu, 2019: 17). Therefore, it becomes a necessity for cities that are open to all these risks to be sustainable and resilient.

The concept of sustainability provides a normative framework that can provide interaction between human communities and the environment and can apply the concept of resistance to every aspect of this framework. Urban sustainability is a concept that requires social solidarity, provides economic empowerment without destroying nature, and aims to raise awareness of the urban environment (Cohen, 2017; Weichselgartner and Kelman, 2014: 29). The concept of urban resilience, on the other hand, has a meaning that expresses the capacity of a city to manage the uncertainties that may be created by risks such as economic, social, and environmental changes, natural disasters, and epidemics, and to adapt to these processes (Ribeiro ve Gonçalves, 2019).

The COVID-19 pandemic, which can be described as a biological disaster, is seen in urban areas at a rate of 95% (UNDP, 2020). Thus, cities are in serious trouble in the face of the spreading COVID-19 virus is at risk, because of the density of people, buildings, and services, and the interconnected infrastructures (Elmqvist, et al., 2019: 267). In resilience discussions, sudden and non-linear dynamics are generally considered. The COVID-19 virus also emerged as a dynamic that emerged suddenly and shook resilience. The following solutions are at the center of the discussions in the urban area with COVID-19: reconsidering urban density planning, replanning urban open and green spaces, replanning urban transportation, reconsidering urban infrastructure and services by increasing the efficiency, deforestation in the urban area and combating biodiversity loss, ensuring urban climate justice, reorganizing urban water and food security, creating sustainable solutions in urban energy, reorganizing urban public health services, increasing smart urban systems (Manzanedo and Manning, 2020; Tuğaç, 2020; SDG Report, 2020).

In these discussions on the sustainability and resilience of cities with COVID-19, four dimensions come to the fore in general (Shulla, et al., 2021: 11): *resilient communities, ecosystem balance, economic sustainability, and global health*. In the first dimension, sustainable cities will be able to create communities that are more resilient to risks. Because sustainability goals include reducing poverty, ensuring gender equality, and creating a healthier environment (Barbier and Burgess, 2020). A balanced and protected ecosystem, which is considered in the second dimension, expresses the environmental dimension of sustainability. In a balanced ecosystem, it will be easier to control the disease and pathogens can be controlled (Yin et al., 2021: 70). Thirdly, economic sustainability refers not only to a growth-oriented economic policy but also to the importance of a resilient economy that can be “self-sufficient” during the disaster and post-disaster recovery (Leach, et al., 2021). In the fourth dimension, some discussions argue that health should be seen as a global crisis. With the pandemic, the health systems of many countries that have committed to implementing sustainability policies have had difficulty adapting to the process. Along with the pandemic, which is a global problem, it has been seen that health has a global dimension (Hakovirta and Denuwara, 2020:3).

Associated with the health risk posed by the COVID-19 pandemic, the issue of public health was discussed in detail in April 2020 with the supplementary document of the “Cities Disaster Resilience Risk Scorecard” prepared by the United

Nations Office for Disaster Risk Reduction (UNDRR, 2020). It has been seen that egalitarian health management with sufficient capacity against all risks is a necessity against both climate risks and epidemics such as COVID-19 (Salas, et al., 2020: 3).

METHODOLOGY

Today, approximately 600 cities in Europe and 9,400 cities around the world act together by being a member of global sustainability-themed networks to achieve their sustainability goals (Uncu, 2019: 50). In this study, three different global urban networks are taken into consideration in designing our research as they include principles such as low emissions, resilience, and fair transition, have memberships of cities from all regions of the world, and present inspections and reports at regular intervals. The selected urban networks are: “*Local Governments for Sustainability (ICLEI)*”, “*C40 Cities*” and “*The Global Covenant of Mayors for Climate and Energy (GCoM)*” organizations. It is important to examine the economic, social, and environmental policies and different management styles of the countries and selected cities, which are seen as important pillars of sustainability and resilience, as they are critical factors in fighting against the pandemic.

In this context, the applications of global urban networks regarding sustainability goals are as follows: *ICLEI (Local Governments for Sustainability)* is a global network of cities made up of more than 1,750 local and regional governments. It is an organization that helps create productive cities with low emissions, an equitable, green economy (advocating equitable, flexible, and circular economy policies), and sustainable transportation within the framework of the principles of “ICLEI Holistic and Integrated Environmental Management” (ICLEI, 2021). *C40 Cities* is a global network established by mayors to implement climate action plans, bringing together 96 cities representing a quarter of the global economy and more than 700 million citizens. The C40 has undertaken the mission of helping its member cities achieve the goals of reducing emissions, investing in clean energy, conserving natural resources, and ensuring a just transition for all (with particular attention to the disadvantaged) to provide the Green New Deal (C40 Cities, 2020). *The Global Covenant of Mayors for Climate and Energy (GCoM)* is a global network of approximately 13,000 city members and their mayors make joint commitments in this network. The main goal of the GCoM is to reduce emissions and promote the building of local climate resilience. In line with these goals, GCoM has undertaken missions such as implementing the principles of the Paris Agreement, supporting local

governments in line with these principles, and encouraging local governments to adopt participatory policies to create fair urban resilience (GCoM, n.d.).

RESEARCH DESIGN

To reach our aim, the pandemic policies and policies of sustainability and resilience of different cities from countries with different management styles, which are also members of ICLEI, C40 Cities, and GCoM networks, were examined. The main purpose here is to examine how the selected differently-sized cities follow policies to achieve their sustainability and resilience goals and evaluate whether they can provide urban resilience through these policies during the pandemic. In this context, the research was designed by choosing two cities of different sizes from countries having different governmental types and administrative structures. The cities of New York and Philadelphia were chosen from the USA, which is a federal country governed by a presidential system; The cities of Curitiba and Rio de Janeiro were chosen from Brazil, which is also a federal country governed by the presidential system; The cities of Berlin and Heidelberg were chosen from Germany, which has a federative structure; The cities of Tokyo and Yokohama were chosen from Japan, whose government is a constitutional monarchy; The cities of Johannesburg and Durban (e-Thekwini) were chosen from South Africa, which is governed by a parliamentary democracy. We tried to include cities from every region of the world in our study (See Table 1). However, we could not include some cities from countries of all different regions in the World due to not covering a membership to three global networks at the same time such as seen in Turkey's case.

The cities selected for the case study were chosen also according to their membership to ICLEI, C40 Cities, and GCoM. In the selection criteria. The size of the city (for big and small size cities we used terms of population and density (infections and deaths)), was claimed to be significant in explaining the city's reactions to resilience. By paying attention to the different scales of the selected cities, the importance of the scale in terms of sustainability-pandemic-resilience will be determined. So, this study contributes to the literature by also revealing how effective different scales and sizes of the cities in regard to sustainability.

FINDINGS

The United States of America

In addition to being the largest economy in the world, the USA is one of the countries producing the most greenhouse gas

emissions, and its attitude towards the climate crisis has an unstable quality that alternates between “taking responsibility or denying it” policies (Uysal-Oğuz, 2020). The most recent example of this situation is seen as Donald Trump's withdrawal from the Paris Agreement in 2017 when he took office and his withdrawal of many environmental protection regulations. Biden, who took office after Trump, returned to the Paris Agreement and acted regarding many environmental policy arrangements (Erensü and Şahin, 2021: 3). However, the deep inequalities created by the intensively implemented neoliberal policies in the country make it difficult to achieve sustainable development goals, which are seen as a concrete implementation tool of climate policies (Çoban, 2016: 32). With the COVID-19 pandemic, while the privatized health system came to the point of collapse because of neoliberal policies, unemployment, and poverty increased in the country with uneven growth, and it became difficult for low-income groups to reach basic needs (Munck, 2021: 17).

The USA's fight against the virus should be divided into two, Trump's presidency and the process after Joe Biden won the election. With the increase in the number of cases and deaths, the primary concern of the Trump administration was about the economy (Yıldızoğlu, 2020). The fact that health services in the USA are based on private hospitals and private health insurance companies has revealed a concrete view of the negativities created by neoliberal policies and the increase in the number of cases and deaths in the USA has been extremely rapid. Although Trump saw the pandemic as an opportunity and wanted to take over the entire executive power beyond his constitutional powers, many states, especially the governor of New York Andrew Cuomo, opposed it and Trump took a step back (Lowndes, 2020: 54). Joe Biden, a member of the Democratic Party who won the US presidential election on November 9, 2020, officially started his duty on January 20, 2021, and first promised “100 million vaccinations in 100 days” and reached this goal on the 58th day of his aim (White House, 2021). However, the increase in the number of cases with different variants and inequalities in access to health services continued during the Biden period. In addition, the problems of unemployment, income inequality, inflation, racism, and gender inequality in the country have deepened with the pandemic (Haffaje, 2021).

New York City

New York City (NYC) is one of the largest metropolitan cities in the world, as well as being a coastal city, it is faced with the devastating risks of climate change. The most important

Table 1. Selected Cities, Their Size, Density and Sustainability Policies

COUNTRY	CITIES	CITY SIZE	POPULATION	COVID-19 CASE DEN- SITY (DEATHS/ INFECTIONS) ¹	SUSTAINABILITY POLICIES
The Uni- ted States of America	New York City	1215 km ² (BIG SIZE)	8,335,897	35,151 / 1,302,064 ~%2,7 (HIGH)	<ul style="list-style-type: none"> •PlanNYC Climate Action Plan •Greener, Greater Buildings Plan •Green New Deal Investments
	Philadelphia	370 km ² (SMALL SIZE)	1,567,258	267,342 / 4344 ~%1,7 (LOW)	<ul style="list-style-type: none"> •The Office of Sustainability - Greenworks •Transport Network Improvement Plans •Community Garden and Urban Forest Practices
Brazil	Curitiba	434 km ² (SMALL SIZE)	1,963,730	304,384 / 7819 ~%2,6 (HIGH)	<ul style="list-style-type: none"> •"Best City to Live in" Award, •"Global Green City" Award, •Recognized as a "design city" in the creative cities network (thanks to Jamie Lerner), •Socio-spatial segregation that can be seen with the center-periphery separation in its urban form.
	Rio de Janeiro	1202 km ² (BIG SIZE)	6,211,423	1,359,453 / 69,513 %5,1 (HIGH)	<ul style="list-style-type: none"> •Sustainability training through the Municipal Education Department •Electric vehicle and carbon pricing policies •High-risk area mapping for disasters (highest risk in so-called favelas slums).
Germany	Berlin	891 km ² (BIG SIZE)	3,800,000	358,365 / 4038 %1,12 (LOW)	<ul style="list-style-type: none"> •Regional centers which are called "Regional Centers for Sustainability Strategies - Regionale Netzstellen Nachhaltigkeitsstrategien – RENN"; •With the "Berlin Energy and Climate Protection Program 2030", the city will become carbon neutral by 2050, •A call to action called the "One Health Berlin Principles" in October 2019. •The city that created and implemented the first climate action plan, •"Passivhouse" project for urban energy efficiency, •Its practices in areas such as sustainable urban logistics, sustainable education, and clean energy have been awarded internationally. •Renewable energy and disaster management policies (especially for earthquakes) are the policies that the city attaches importance,
	Heidelberg	109 km ² (SMALL SIZE)	161,257	10,609 / 81 ~%0,8 (LOW)	<ul style="list-style-type: none"> •Its goal by 2050 is to switch to zero carbon and meet its energy needs from renewable energy sources, •In this city, where seismic activity and natural events due to the climate crisis are very intense, "resilience and sustainability" come first. •Since 2003, it has received an "eco-model" city award through urban waste management, •Conducts hydrogen energy investments and decarbonization policies. •It is seen as an incubation center for the smart city project. •The water resources within the city's borders have been mapped, •EWS (The eThekwini Water and Sanitation Unit) water and sanitation service expanded throughout the city, •Urban agriculture practices have been expanded both in the city center and in the city periphery.
Japan	Tokyo	42,143 km ² (BIG SIZE)	13,960,000	389,728 / 3175 %0,8 (LOW)	<ul style="list-style-type: none"> •Its goal by 2050 is to switch to zero carbon and meet its energy needs from renewable energy sources, •In this city, where seismic activity and natural events due to the climate crisis are very intense, "resilience and sustainability" come first. •Since 2003, it has received an "eco-model" city award through urban waste management, •Conducts hydrogen energy investments and decarbonization policies. •It is seen as an incubation center for the smart city project. •The water resources within the city's borders have been mapped, •EWS (The eThekwini Water and Sanitation Unit) water and sanitation service expanded throughout the city, •Urban agriculture practices have been expanded both in the city center and in the city periphery.
	Yokohoma	560 km ² (SMALL SIZE)	3,771,640	78,141 / 591 ~%0,8 (LOW)	<ul style="list-style-type: none"> •Conducts hydrogen energy investments and decarbonization policies. •It is seen as an incubation center for the smart city project. •The water resources within the city's borders have been mapped, •EWS (The eThekwini Water and Sanitation Unit) water and sanitation service expanded throughout the city, •Urban agriculture practices have been expanded both in the city center and in the city periphery.
South Africa	eThekwini (Durban)	2290 km ² (BIG SIZE)	3,720,953	~410,000 / ~3000 %0,7 (LOW)	<ul style="list-style-type: none"> •EWS (The eThekwini Water and Sanitation Unit) water and sanitation service expanded throughout the city, •Urban agriculture practices have been expanded both in the city center and in the city periphery.
	Johannes- burg	1645 km ² (SMALL SIZE)	6,065,354	1,148,889 / 20,270 ~%1,8 (HIGH)	<ul style="list-style-type: none"> •Focusing on energy security about climate change through the organization SALGA (South African Local Government Association), •Urban agriculture and agroecological agriculture incentive policies are carried out together with the "Green Economy Strategy".

• Highly dense cities are over %1-%25.infection density-case fatality ratio (WHO-COVID-19, 2020).²

• Lowly sized cities lower %0-%1 infection density-case fatality ratio (WHO-COVID-19, 2020).

1 The number of cases and deaths is the total number of February 20th, 2022. These numbers are taken from the total number of cases and deaths officially announced on the web pages of the city administrations.

2 The table shows the number of cases and deaths according to the "case fatality rate calculation" determined by the World Health Organization. CFR (%)=(Number of deaths from disease×Number of confirmed cases of disease)×100 (WHO-COVID-19, 2020).

policies regarding the environmental aspect of sustainability goals in New York City are aimed at reducing carbon emissions. 73% of New York's carbon emissions come from buildings in the city. For this reason, the law package called "Greener, Greater Buildings Plan" was put into effect in NYC in 2009 and it was aimed to increase energy efficiency in existing buildings. Therefore, NYC increases its "Green New Deal" investments and makes global collaborations in areas such as clean energy, zero waste, zero carbon, and environmental justice (Rosan, 2011: 962). NYC aims to base its recovery strategies in the post-pandemic period on sustainability policies. As a concrete step towards this goal, NYC Mayor Bill de Blasio accepted the C40 Cities' statement of principles for a healthy, equitable, and sustainable recovery (C40 Cities, 2020).

Due to the elevated risk of COVID-19 transmission in enclosed spaces, the use of open and green spaces has increased in NYC (NYC Parks, n.d.). In a study conducted in the city, it was determined that the increase in the use of urban green space was mostly seen in the middle and high-income groups. The main point on which this determination is based is that middle and high-income groups have switched to the home working system during the pandemic process, paving the way for them to spend more time in these areas. It was concluded that low-income groups, on the other hand, could not find free time to go to green areas due to continuing their work and they were afraid of these crowded areas due to the risk of virus (Pipitone and Jovic, 2021). Another inequality situation is observed in access to the COVID-19 vaccine. The problems in the health system of the USA were also reflected in NYC, and it was seen that low-income groups and black citizens living in the city were more affected by the epidemic (Yu, et al., 2021; Truong and Asare, 2020). NYC is one of the cities that started vaccination processes early. However, it has been observed that the first places where these early vaccination processes were initiated are the neighborhoods where middle and upper-income groups live. On the other hand, it has been observed that there were problems such as vaccine supply, multiple-dose scheduling, and vaccine appointments in regions where Black and Latino groups and low-income groups live (Williams, et al., 2021). In the face of the impact of the COVID-19 pandemic, it is possible to say that NYC could not increase social resistance and the policies implemented did not have a holistic effect.

Philadelphia

There is an agent called "The Office of Sustainability" and this agent implements, monitors, and supervises policies such as

accessible food, clean water, clean air, renewable energy, carbon neutral practices, social and environmental justice, and zero waste through practices under the name of "Greenworks" (Stanko and Naylor, 2018: 470). Moreover, the city's climate action plan includes practices such as urban forest initiatives to cool the city, activities to improve the transportation network plan, and community gardening (Office of Sustainability, n.d.). However, due to the increasing construction sector in the city, these gardens are also open for construction and there is a serious decrease in urban green areas. This situation carries the risk of urban food insecurity (Saffron, 2020). In addition to these problems brought about by the increase in the construction sector, there is also a serious housing problem for low-income groups. While many people live in shelters that were built for the homeless because of the high rents, a significant number of cases have been seen in these houses during the COVID-19 process (Saffron, 2020). Moreover, low-income groups faced difficulties in accessing food during the COVID-19 process (Brown, et al., 2020: 314).

The most consequential reason for poverty in Philadelphia is based on racial discrimination and the economic inequalities associated with it (Bilal, et al., 2021). Hispanics and African Americans living in the city are more exposed to these inequalities, and their vulnerability increases in the face of all crises (Adams, 2014). A study on the epidemic showed that Black and Hispanic people had 3 times higher rates of hospitalization and death due to COVID-19 than white people (Bilal, et al., 2021). Racial discrimination from the past to the present is seen as the main cause of inequalities in both the spatial structure of the city and the economic structure.

Brazil

Brazil is one of the countries that have serious shortcomings in ensuring social and economic justice and is one of the countries that are inadequate in terms of environmental sustainability policies. Although it was announced at the beginning of 2019 that there were not enough resources to respond to the fires in the Amazon region, many environmental laws were abolished in the country and many of the protective laws were abandoned (Abessa, et al., 2019: 510). Indigenous people living in the Amazon region blamed the country's president, Jai Bolsonaro, for not preventing deforestation and encouraging activities such as mining and logging in the Amazon region (Miranda, 2020). Although Brazil is among the top ten economies of the world, it is the country with the highest income inequality and poverty in the Latin American region (Uysal Oğuz and Sezek, 2020: 171).

In the early stages of the epidemic, Bolsonaro's harsh rhetoric against local rulers who supported a full shutdown and his threat to send the army offered a concrete view of the political inconsistency in the country (de Barros, 2020: 18). In general, in Brazil, income inequality, social injustice, and spatial injustices due to the lack of delivery of public services to some parts of the country cause social fragility to rise (Uysal Oğuz, 2020: 5).

Curitiba

Architect and city planner Jaime Lerner, who was seen as the pioneer of Curitiba's sustainability steps and was mayor in different periods between 1970 and 1992, argued that urban sustainability is a holistic dimension and that reducing the use of private cars is a meaningful step for sustainability. With a design that brought the Metrobus system as it is known today to the world, he tried to show that public transportation in urban transportation creates less fuel consumption and stronger socialization areas (Cirit, 2014: 57).

In the urban form of Curitiba, while middle and high-income groups live in the center of the city, low-income groups live in the urban periphery. Housing policies that enabled low-income groups to be in the vicinity of Curitiba in the 1970s led to spatial inequality today with the COVID-19 pandemic. Most of the cases and deaths in the city consist of low-income groups living in the urban periphery (Perotti and Driessen, 2021). The city is implementing its local policies regarding the pandemic through an application called the "PlanC Project", a platform that supports both local services and more vulnerable communities. This platform, aims to minimize the risk of vulnerable and fragile communities being affected more by the COVID-19 pandemic, to cooperate with local businesses for risk reduction, and to monitor vaccination processes (World Economic Forum, n.d.).

Although Curitiba has been shown as a model proposal to other cities with the "PlanC Project" in its fight against the pandemic, it has not fully solved the problem of socio-spatial inequality. In the south of the city, public transportation services are scarce in this region, and the intensive use of existing public transportation continues despite the pandemic. Therefore, the number of cases in this region is higher when compared to the city as a whole. The fact that health services are in the city center, the population in the periphery has difficulties in reaching the urban center, and the problems experienced in accessing the COVID-19 vaccine deepen socio-spatial inequality (Souza and Bega, 2020).

Rio de Janeiro

After hosting the UNFCCC in 1992, Rio de Janeiro has been trying to carry out its sustainability policies effectively. To reduce carbon emissions, the use of light-duty electric vehicles in urban transportation has been increased and policies such as carbon pricing have been adopted (Silva et al., 2020). After the flood disaster experienced throughout the state in 2010, high-risk area assessments were made with mapping methods to increase urban resilience (Barbosa and Walker, 2020). 22% of the population of Rio de Janeiro live in slums called "favelas" and those areas have the highest value on risk maps. These regions are places with high disaster risk, high social fragility, and inadequate urban services such as housing, health, education, and lighting. With the COVID-19 pandemic, which is described as a biological disaster, serious vulnerabilities are observed in favelas, both in the field of health and socially (Bernardo et al., 2021: 596). Favelas are conducting a local solidarity process to increase their social resilience during the pandemic process (UNIC Rio, n.d.). With the solidarity networks they have established, actions are carried out through non-governmental organizations, universities, and individual initiatives in their areas such as facilitating access to information on the pandemic, ensuring food safety, creating solutions for drinking water problems, conducting free testing and treatment processes, and monitoring vaccination processes (Fernandes, ed., 2020).

The city administration had lifted the full closure measures it had taken to prevent the spread of the virus, with the trend of the number of cases falling. This situation has caused both an increase in the number of cases and the rapid spread of mutation virus species called "Brazil and Delta variants" (Ferraz, 2021). In the studies conducted in the city, it has been concluded that the deaths due to COVID-19 are higher in the densely populated low-income population (Schiray, 2021). Therefore, it is possible to say that the vulnerable communities living in the city are not resilient and therefore their local policies regarding the social dimension of sustainability goals are insufficient (Bernardo, et al., 2021; Fernandes, et al., 2020).

Germany

Germany is the country with the highest greenhouse gas emissions among European countries. Besides that, as one of the countries that assume the most responsibility, it implements projects that include actions aimed at adopting clean energy initiatives, reaching sustainability goals until 2050, and adopting "adaptation and mitigation" strategies (Scholz, et al., 2016).

However, in the elections held in 2021, a coalition government was formed in which a green party is also in the coalition, and it is stated that the “carbon-neutral” target is also included in the coalition agreement (DW, 2021).

In Germany, which has a federal structure, local policies depend on the states that make up the federative structure. For this reason, there is no central health authority in the management of the pandemic process in the country, but a local and national struggle, in which 16 states are responsible for their regions. Germany, which has enacted the National Infection Protection Law, has set three goals in the fight against the epidemic: to protect health and maintain the effectiveness of the health system, to mitigate the economic impact of the pandemic, to manage the epidemic with international cooperation (Jochen, 2020: 2).

Berlin

In Berlin, sustainability policies are carried out together with the German Sustainable Development Strategy, the Federal Government, non-governmental organizations, and all other actors. There are regional centers called “Regional Centers for Sustainability Strategies - Regionale Netzstellen Nachhaltigkeitsstrategien – RENN” to achieve sustainability goals. With the “Berlin Energy and Climate Protection Program 2030” adopted in 2018, it is aimed at the city to become carbon neutral by 2050 and to implement adaptation policies for climate change. The city has various policies and practices on many issues such as urban temperature, buildings, green space, air, water, infrastructure, and energy to adapt to climate change and climate crises (SDGs in Berlin, n.d.). Combining global sustainability principles with global health principles, Berlin prepared a call to action called “One Health Berlin Principles” in October 2019, and a short time after this call, the COVID-19 epidemic started. The “One Health Berlin Principles,” consists of 10 items created by experts from different disciplines that are aimed to improve the health of people, animals, and common environments (ecosystem, biodiversity, urban green spaces, etc.) in a holistic manner and line with ethical principles. Berlin declares that it will base the post-pandemic recovery process on these principles (Gruetzmacher, et al., 2021).

The first measure taken by the municipality was to meet the “emergency childcare” and “elderly care” services for the groups that had to work during the pandemic restrictions. In addition, due to the risks posed by public transport, the number of additional bicycle lanes and bicycles belonging to the

municipality has increased. With the decisions made afterward, these bike paths were made permanent (Umwelt Bundesamt, 2020: 18). Support was given to occupational groups, employees, and business owners affected by the epidemic (The Governing Mayor of Berlin, 2021). For the homeless living in the city, since the beginning of the pandemic, the city administration has been placed in hotels, and the testing, treatment, and vaccination processes have been followed (DW, 2020; Euro Cities, 2021). In addition to being a city that takes pioneering steps in the implementation of sustainability principles on a local and global scale, Berlin also carries out integrative policies that can set an example during the pandemic process.

Heidelberg

Heidelberg was the first city to create and implement a climate action plan for sustainability at both state and country levels (Graczyk, 2015: 211). The city’s most significant application in this area, which aims to manage urban energy efficiency in a climate-sensitive manner, is the “Passivhaue” project. The most outstanding feature of the “passive houses” is that the building is energy efficient, has a carbon-neutral application, and has a design suitable for the urban heat island effect (C40 Knowledge, 2021). The resistance that the city tries to provide in both its spatial structure and management strategies with a green understanding also comes to the fore during the COVID-19 pandemic process. In a city with a population of approximately 160,000, the number of COVID-19 cases and deaths is low (Coronavirus Die Lage in Heidelberg, 2022).

In Heidelberg, measures and policies regarding COVID-19 are carried out by the Baden-Württemberg state regulation to which the city is affiliated. Information about the epidemic is provided throughout the state through the web page of the local government and the “CORONA WARN-APP” mobile application (Coronavirus Die Lage in Heidelberg, 2022). For the public health crisis caused by the pandemic, the city administration offers various support to scientists from different disciplines so that they can act jointly (Allianz von Heidelberger, 2020). The effective implementation of public health policies in Heidelberg, the determined policies of the city administration towards climate, and the lack of a dense urban population ensure high resistance during the pandemic process.

Japan

Japan is one of the top five countries most responsible for global emissions. It had committed to reducing its emissions by

26% by 2030. Although Japan announced that it will increase this rate in the 2018 Green Climate Fund renewal process, it has been reported that its efforts are insufficient, and it remains below its target carbon emission rate (Climate Action Tracker Japan, 2021). Aiming for a green recovery after the COVID-19 pandemic, Japan is increasing its investments in hydrogen energy to reduce carbon emission rates (GZR, 2020).

Japan is a country where a constitutional monarchy and a parliamentary government system are run together and have a decentralized structure. Therefore, the fight of local governments against the epidemic progresses depending on the central government, but it is quite insufficient in terms of financial aid related to the epidemic (Suppasri, et al., 2021). Due to its elderly and crowded population and its proximity to China, Japan carries out the emergency action plan that it has put into effect since the beginning of the epidemic. The most essential elements in Japan's fight against the virus are early diagnosis, early intervention, improvement of intensive care services, and rapid adaptation of citizens to the measures (Iwasaki ve Grubaugh, 2020). However, as of January 2021, Japan started to have difficulties in controlling the epidemic, delays in the vaccination process that went well, and an increase in the number of cases compared to other Asian countries observed (Fritz, 2020). The period with the highest number of cases in the country is seen in July 2021, when the Summer Olympics are held (Kelly and Slodkowski, 2021).

Tokyo

The renewable energy and disaster management policies of the Tokyo Metropolitan government highlight the city in terms of sustainability. The city of Tokyo, in line with international policies, aims to switch to zero carbon and meet its energy needs from renewable energy sources by 2050 (Kishimoto and Kobari, 2020). The city government is making hydrogen energy investments to reach its carbon-neutral target (Kato and Kurosawa, 2019). The city, which is located on the ocean coast, is also faced with many risks due to its location in the earthquake zone (Akyüz, 2021: 70). In this city, where seismic phenomena and natural events due to the climate crisis are intense, "resilience and sustainability" are the policies that take first place (Gülçen Eren, 2019: 918).

Tokyo, which has a large population, is a city with a high rate of elderly population. Despite this, the most important reason for the low number of cases and death rate in the city is the experience of the Spanish flu epidemic in 1918. Thanks to this experience,

Tokyo was able to immediately implement applications such as fast and free testing, contact tracking systems, and isolation (Updates on COVID-19 in Tokyo, 2022). The highest number of cases seen in the city was experienced after the Summer Olympics in 2021. While the benefits that such organizations will provide to a city under normal conditions are high, it has led to an increase in the number of cases under pandemic conditions and the re-implementation of state of emergency decisions in the city (Kelly and Slodkowski, 2021).

The most considerable reason for the low number of cases in Tokyo is that the city administration is subject to harsh sanctions to create an emergency action plan and the society to comply with it. Although Tokyo is in a high-risk region, it has had difficulty in coping with many problems brought on by the pandemic, even though it implements resilience and sustainability policies. The pandemic process, as seen in the Tokyo example, provides some clues to the difficulties that growth may create in the future.

Yokohama

Rapidly industrializing and rapid urban development, Yokohama started a waste program in 2003 regarding its crucial environmental problem, urban waste. With this program, approximately 43% of urban waste is recycled (Ito and Reid, 2020: 1657). Within the scope of the "eco-model cities" program initiated by the Japanese government, Yokohama is seen as an "eco-model" with the best solid waste management policies in the country (Kerimova, et al., 2020: 21). In addition, the city creates regional incentives to reduce greenhouse gas emissions, carries out hydrogen energy investments and decarbonization policies, and has been expanding environmental education practices at all education levels throughout the city since 2006. The Japanese government sees Yokohama as an incubation center for the "smart city project" by the reason of its environmental policies and aims to implement smart urban systems in the city (Suwa, 2020: 393).

The Olympics held in Tokyo also affected the city of Yokohama, and a serious increase was observed in the number of cases in the city after the Olympic races. Although this increase caused strain on the city's health systems, rapid treatment processes could be provided thanks to the city's local and global networks (The Asahi Shimbun, 2021). The city administration has created a special team called Y-CERT (Yokohama Coronavirus Emergency Response Team) to respond quickly to new cases (Mayor Message, 2021). Yokohama also manages the

vaccine supply and rapid vaccination processes well, thanks to these networks and its health system (Open Yokohama, 2022).

Yokohama is a city that strives to implement sustainability policies to increase its urban resilience due to its geography. With the COVID-19 pandemic, increasing the resistance against epidemics has become one of the city's other goals.

South Africa

The Republic of South Africa, which is described as a regional actor in the African continent, is governed by a parliamentary democracy based on the presidential system. With the signing of the Paris Agreement, South Africa took decisions on renewable energy actions, decarbonized electricity, carbon tax practices, and the national adaptation process. However, South Africa needs international support to achieve these goals (Council of the EU, 2013). The existing socioeconomic inequalities, hunger, access to clean water, and diseases in the region have reached serious dimensions with the COVID-19 pandemic (Maulds, 2020). Along with the pandemic, South Africa is seen as the country that can best manage the restriction measures, vaccination, and treatment processes in the African continent. However, since South Africa is a country that provides food security and supply in the African continent, the disruptions in the supply chain by the epidemic triggered not only the virus risk but also the risk of hunger throughout the continent (Wegerif, 2020: 798).

In the country where immigrants from other countries on the African continent are concentrated, applications such as vaccines and treatments are not carried out for immigrants during the COVID-19 pandemic. This situation not only increases the rate of spread of the virus in the country but also causes an increase in the number of cases and deaths (Mukumbang, et al., 2020).

eThekwini - Durban

Insufficient water resources common in South Africa are one of the main problems of the region. Durban municipality has mapped the water resources within the city limits to solve this problem (Sim et al., 2016: 45). The water and sanitation unit called EWS (The eThekwini Water and Sanitation Unit), established by the municipality, serves water and sanitation policies throughout the country by addressing the dimensions of “economic, service and spatial differentiation” (Sutherland et al., 2014). To solve the problem of poverty and food insecurity prevalent in the African region, the municipality of Durban has expanded urban agriculture practices both in the city center and

in the city periphery. However, these practices are insufficient due to the socioeconomic inequalities existing in the city (Khumalo and Sibanda, 2019: 2).

Durban, one of the biggest cities in South Africa, is weaker in sectors such as tourism, production, and logistics when compared to other big cities. Therefore, this weakness in the current economic structure of the city has deepened with the pandemic (Mantzaris ve Ngcamu, 2020: 119). Increasing unemployment rates due to the pandemic affected the service sector and a serious loss of capital was experienced in the city as investors withdrew their money from the markets. To manage this process, eThekwini Municipality established a local economic intelligence program called Durban Edge and provided support to certain levels of sectors during the mandatory shutdown periods (Maharaj and Reddy, 2020: 207).

Another situation experienced in Durban is the evacuation of unregistered city residents from their homes and the city due to COVID-19. The municipality based this application on the reasons such as providing basic services better and increasing public welfare and did not carry out any policy regarding the accommodation of people who became homeless because of evacuations (Kihato and Landaou, 2020). The deficiencies regarding basic needs in the city have deepened with the pandemic and the problems of vulnerable and disadvantaged groups have grown as a result of social exclusion.

Johannesburg

Johannesburg, which is the largest city in South Africa, unlike the national government, pays attention not only to reduction strategies but also to adaptation strategies (Mokwena, 2009: 27). In addition to policies at the national level, energy security has been focused on about climate change through the organization called SALGA (South African Local Government Association), which was established to increase cooperation and solidarity between local governments (SALGA, 2013). The municipality of Johannesburg aims to prevent food insecurity with its “Green Economy Strategy” in 2013 with urban agriculture practices and carries out policies to encourage agroecological agriculture (Kroll, 2021). Despite all these incentives and supports, Johannesburg remains far from the social goals of its sustainability goals due to problems such as gender inequality and unjust income distribution (Vyas-Doorgapersad, 2017: 173). When the COVID-19 pandemic is added to the existing vulnerabilities, both the economic and social fragility of the city increased (Ekumah, et al., 2020).

Table 2: Findings on the selected cities by their size, density, and resilience to the COVID-19 Pandemic

COUNTRY	CITIES	CITY SIZE	COVID-19 CASE DENSITY (INFECTIONS / DEATHS)	RESILIENCE IN THE PANDEMIC PERIOD
The United States of America	New York City	(BIG SIZED)	(HIGH)	<ul style="list-style-type: none"> •“Safe Haven” centers for the homeless, •Problems in the health system in general, •Low-income groups and blacks are more affected, •Inequalities in access to treatment (including vaccines) (Black and Latino groups and low-income groups are at a disadvantage), •Social and economic resilience is low.
	Philadelphia	(SMALL SIZED)	(LOW)	<ul style="list-style-type: none"> •Due to the increase in the construction sector and high rents, many people were staying in shelters and higher COVID-19 cases were observed in these houses, •The problem of racism (infections and deaths were mostly observed in Hispanics and African-American citizens), •There was an increase in layoffs, •Urban resilience is very low due to the social, economic, and growing construction sector.
	Curitiba	(SMALL SIZED)	(HIGH)	<ul style="list-style-type: none"> •An application called “PlanC Project” for the pandemic. •Most cases and deaths are from low-income groups living in urban periphery. •Health services are in the city center, and the population in the periphery has difficulties in transportation to the urban center. •Due to the problem of socio-spatial inequality, social, environmental, and urban resilience is low.
Brazil	Rio de Janeiro	(BIG SIZED)	(HIGH)	<ul style="list-style-type: none"> •Case numbers were observed mostly in “favelas”. •Favelas tried to resist the pandemic with their own neighborhood solidarity networks •Due to income inequality and spatial inequalities, its resilience has further decreased during the pandemic period.
	Berlin	(BIG SIZED)	(LOW)	<ul style="list-style-type: none"> •To handle “emergency childcare” and “elderly care” services during the pandemic period, •Urban services for access to clean and healthy food, •Homeless people have been placed in hotels by the city administration since the pandemic process started, •In addition to the social and health fragilities during the pandemic process, economic fragility has been prevented to a significant extent.
Germany	Heidelberg	(SMALL SIZED)	(LOW)	<ul style="list-style-type: none"> •Pandemic policies in the Baden-Württemberg state regulation are carried out, •Notifications through the “CORONA WARN-APP” mobile application, •The city administration offers various supports to scientists from different disciplines so that they can act jointly, •The determined policies of the city administration towards the climate and the lack of a dense urban population ensure high resistance during the pandemic process.
	Tokyo	(BIG SIZED)	(LOW)	<ul style="list-style-type: none"> •Urgent action plan and harsh sanctions for society to comply with this plan, •They could not control the increase in cases during the Summer Olympics, •Due to being a large and crowded city, they had difficulty providing social resilience, •The increase in the number of cases during the international Summer Olympics, which is a critical issue in the growth of a city, paved the way for discussions on the future of growth.
Japan	Yokohama	(SMALL SIZED)	(LOW)	<ul style="list-style-type: none"> •A special team named Y-CERT (Yokohama Coronavirus Emergency Response Team) has been formed, •Due to the Summer Olympics, the number of cases has increased, and the city’s health systems have been challenged, •Urban resilience and sustainability are necessary in this city where seismic activity is intense. For this reason, policies have been prepared to increase resistance against epidemics.

South Africa	eThekweni (Durban)	(BIG SIZED)	(LOW)	<ul style="list-style-type: none"> •During the pandemic period, unemployment increased, the service sector weakened and investments in the country decreased, •Support was given to sectors at the levels determined by the Durban Edge policy, •The number of cases and deaths is not disclosed and there are doubts about the reliability of the figures announced, •Increase in social exclusion •The vulnerability of the city has increased with the pandemic due to deep income inequality, deprivations in the health system, and social exclusion. It needs outside support.
	Johannesburg	(SMALL SIZED)	(HIGH)	<ul style="list-style-type: none"> •Gender inequality and income distribution inequality in the city is very high and this situation has deepened with the pandemic, •There have been great difficulties in accessing water and food during the pandemic process. •The social, economic, and environmental resilience of the city is quite low. For this reason, it needs international support.

Johannesburg is a city that receives a lot of immigration because it is one of the economic centers of South Africa. For this reason, the most intense COVID-19 cases in South Africa were seen in this city (Gauteng Cases, 2021). As in other cities of South Africa, the current difficulties in accessing water and food in Johannesburg have caused an increase in social anxiety due to the full closure practices implemented due to COVID-19 (Ekumah, et al., 2020). The death of the mayor of Johannesburg, Geoff Makhubo, on 9 July 2021 due to COVID-19 has further increased this concern (Stoltz, 2021). Therefore, the state of both social and physical resistance, which existed in the current situation of the city before COVID-19, has deepened with COVID-19.

DISCUSSIONS AND CONCLUSION

The pandemic, which emerged as a global public health crisis, has turned into a social, economic, and spatial crisis experienced by the capitalist world, with all networks locked. It has also been proven that the climate crisis, another global crisis, would have the same effect. Today, states that admit that they are unprepared for the crisis created by the pandemic, in their discourse on the pandemic, list the various targets they have signed under international climate agreements and explain their post-pandemic recovery strategies. This study paves the way for discussions on whether engaging global sustainability networks are effective in achieving sustainability goals, and whether participating in these networks would be enough for economic, social, and environmental resilience of cities or not.

Findings showed that (see Table 2) although some progress has been made in terms of resilience and sustainability in small-sized cities in the USA, it is seen that there are still problems such as “poverty and homelessness” in the social dimension of sustainability in large-sized cities. This can be explained by the arms’ length state policy of the USA which does not pay enough

attention to social dimensions of resilience such as excluding Black and Latin groups stimulating the vulnerability of the large-sized cities in adapting the COVID-19 crisis.

The first situation encountered in cities in Brazil (see Table 2) is social income inequality and inadequacies in basic needs. Although these cities make commitments to achieve their sustainability and resilience goals, the vulnerabilities of low-income groups living on the periphery of the city are high due to income inequality. We have seen no difference between big and small-sized cities in adapting to the COVID-19 crisis. Because the inequalities have mainly caused low-income groups to be positioned intensively in the city peripheries, and it has been observed that the number of cases is high in these regions. It has been observed that existing spatial inequalities increase vulnerability more during the epidemic process which must be supported by national and local policies strongly.

In the cities of Germany, the strong local policies in adapting to COVID-19 also depend on strong national policies on sustainability issues. We have seen an important role of bottom-up policy making in the welfare state regulations which make cities adaptive to crisis regardless of their size. We have seen that each city has the flexibility to create its policies. German cities which have a strong local economy and fiscal decentralization allow them to carry out their policies on sustainability and resilience together.

We have seen that the local policies in Japan on adapting to COVID-19 are in line with the national policies. National-local integration in policies makes cities adaptive to this crisis both in big-sized and small-sized cities. The rapid adaptation of society to the restrictions related to the pandemic is perceived as a normal attitude which is in line with its authoritarian management style of the Japanese state.

Problems such as access to basic physical and social needs and unequal income distribution existed in South Africa before the pandemic reached serious dimensions. Exclusionary policies towards immigrants in the country are observed in the selected cities. We have seen a striking difference between big and small-sized cities in adapting to the COVID-19 crisis in South Africa. While small sized city, Durban, had a high density of cases during the pandemic, big-sized Johannesburg had relatively low dense cases during COVID-19. This is related to reaching the basic needs. It will not be possible to achieve the goals of resilience and sustainability without providing for basic needs and social and spatial justice in the country. So, states should consider the equal distribution of social and physical resources in adapting to be resilient during the crisis.

We have found that small-sized cities adapted to the COVID-19 crisis more than big-sized cities. However, the social infrastructure need should also be taken into consideration in adapting resilience as the Curitiba, Brazil case shows. Choosing different cities with varying sizes shows that sustainability and resilience policies of a strong state and welfare system support are important in the resilience of cities.

It is also seen that the sustainability and resilience targets determined by the global urban networks do not have an influential effect in adapting cities to resilience, under the risk conditions created by the pandemic. Sustainability targets should not remain in discourse and effective policies (such as distributing equal infrastructure and social support to cities regardless of their size but by considering the density of the population) should be considered not only at global level agreements but also by national and local policies and actors which have a significant role on designing resilient policies. Findings showed the necessity of social and physical dimensions of a multi-layered process of decision-making involving local, national, regional, and transnational actors in adapting to global environmental problems such as epidemics and climate crises.

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