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GLOBAL WARMING CITY PLANNING STUDIES: A TRANSDISCIPLINARY APPROACH TO SUSTAINABLE CITIES

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ABSTRACT

This paper describes the shift in urban planning strategies toward more sustainable cities. The United Nations General Assembly's Sustainable Development Goals (SDGs) span from poverty eradication to education improvements to the preservation of global assets such as seas and climates. Achieving these broad objectives requires comprehensive and cross-disciplinary methods. Because the SDGs are inextricably linked to urban activities, urban planning is one of the most effective strategies for achieving them. In this article, we first outline a conceptual framework for the interplay of urbanization and climate change, and then predict the future trajectory of increasing worldwide urbanization in this century, as well as the resulting sustainability issues. Then, as sustainable science, we examine the path of urban planning analysis to address sustainability issues, and we suggest the cross-assessment method for vision-led urban planning. The cross-assessment method seeks to investigate synergistic solutions integrating various value systems by evaluating the effects of measures pursuing each value component on a variety of outcome indicators. The case studies for the cross-examination are drawn from Japanese public transportation policy. Finally, we examine the effects of socioeconomic changes and technical development on urban growth, particularly in the areas of transportation, building, and communication.

KEYWORDS: *Sustainable, Development, Urbanization, Global Warming, Disciplinary*.

1. INTRODUCTION

Both urbanization and climate change are projected to accelerate in the twenty-first century, having a major reciprocal effect as they interact. Technological breakthroughs, particularly in the fields of building and transportation, have increased productivity and quality of life in megacities, which are not only enormous but also growing in population. While increasing productivity in cities meets people's requirements, increases in population and concentration, as well as economic development, have boosted energy consumption and greenhouse gas (GHG) emissions in cities. Climate change is expected to have a broad variety of effects on human activity, with cities in poor nations particularly susceptible to severe weather and meteorological catastrophes [1].

The Intergovernmental Panel on Climate Change (IPCCfifth)'s assessment report (AR5) (IPCC 2014) highlights possible climate change effects on metropolitan areas. These climatic hazards have an impact on critical resources such as water, food and energy supply, public health, and infrastructure. Furthermore, it is projected that urban activities account for more than 70% of worldwide CO2 emissions (Marcotullio et al. 2013; Grübler et al. 2012). As a result, we must comprehend the interactions between urban activity and climate change. Adaptation to climate change is seen as a chance for urban regions to develop and revolutionize, but structural changes to urban systems to fulfill adaptation requirements will have significant effects on the efficiency of urban operations and inhabitants' quality of life. In other words, effective methods to sustainable urban design may help to realize the co-benefits of climatic catastrophe risk reduction and urban system upgrading. Furthermore, if we do not pay enough attention to the mechanisms of urban activities or citizen values, climate change mitigation or adaptation strategies may restrict urban activities to the point of lowering quality of life [2].

We explore the framework of urban planning research for the co-evolution of climate policy and urban planning in this paper. While each city has unique urban planning problems, the total GHG emissions of all cities have a worldwide impact on the climate. To comprehend the connection between urban activities and climate change, we must perform an urban study of all cities worldwide, taking into account numerous specific cities. Furthermore, climate change has very long-term consequences that are well beyond the purview of previous urban planning studies. Because the essential research techniques for integrating both the long-term and global scales have not been developed, we believe a new framework is required [3]. Section investigates a long-term and global-scale urbanization issue under IPCC scenarios. Section addresses the necessity for transdisciplinary methods and explains how sustainability science has become the new path of urban planning research. Section 5 covers cross-assessment analysis using Japan's public transportation policy to demonstrate how vision-led planning integrates stakeholders' sense of values. Section examines the effects of technology innovation on urban activities and planning [4]. The main location of economic activity is in urban regions. As a result, these economic activities generate GHG emissions, necessitating mitigation and adaptation to climate change. Some adaptation efforts, such as large infrastructure to combat climate catastrophes, may result in substantial GHG emissions [3].

As a result, climate change and urban activity interact. Climate change may alter the geographical and temporal patterns of temperature and precipitation, influencing demand for heating and cooling, the cost of using water resources and food supply, and public health. Sea level rise is also anticipated to increase the danger of high tides, which may damage both public and private fixed capital in coastal towns as well as degrade land resources. All of these effects may raise the cost of urban activities; however, the effects are unevenly distributed across the world and vary per city. There are many climate change adaptation strategies, but their effectiveness varies, and certain solutions may raise not only the expense of urban activities but also GHG emissions.

Research for cities in underdeveloped nations is just as important as research for cities in wealthy ones. Many cities in emerging nations are projected to undergo significant urbanization in the future. GHG emissions are influenced by urban structure, and it is generally difficult to change the structure after it has been built. As a result, cities whose future development is anticipated are the most effective targets for climate policy. Different trajectories of urban development will be induced by urban planning: certain designs may result in ecologically friendly urban structures, while others may not. Planning also has an effect on the efficiency of urban operations and the quality of life; thus, we must examine the different variables in conjunction with the long-term impact of climate change [5]. Many researches on the effect of climate change and adaptation strategies in urban settings have been evaluated in the IPCC-AR5, Working Group II, Chap. 8. The study emphasizes the need of taking climate change effects into account in metropolitan areas, such as increased risk of sea level rise, high tide, heat wave, rainfall, flood, landslide, drought, water shortages, and air pollution. All of these hazards are thought to have a significant impact on water and energy sources, public health, social infrastructure and development, and ecosystems. Furthermore, they said that risk adaption strategies may offer an opportunity for urban development and the promotion of innovation [2]. However, the routes via which climate change affects urban activity are complex. For example, changes in precipitation patterns may result in drought in certain places, affecting water supplies in urban areas as well as agricultural Urban Planning Research in the Climate Change Era productivity. The latter may influence food prices and security, as well as migration from rural to urban region. Rising sea levels will increase the size and frequency of high tides, affecting people, fixed assets, ecosystems, and causing damage to port infrastructure and industrial units near coasts [6].

The effect of adaptation strategies is difficult to generalize since it varies depending on the circumstances of climate effects and the economic levels of cities. Less developed nations are often unable to invest in water resource infrastructure or climate catastrophe protection systems, making them more susceptible (IPCC 2014). Tide embankment is regarded a cost-effective strategy to avoid climate catastrophe in coastal regions if it is cheap; nevertheless, development of these embankments may release significant volumes of GHGs. Desalinated saltwater is used in certain nation water sources, which needs energy-intensive systems and may contribute to global GHG emission.

2. DISCUSSION

Understanding future global urbanization is critical in order to evaluate the connection between urban activity and climate change. Because long-term socioeconomic conditions in this century are uncertain, climate policy studies consider a variety of socioeconomic possibilities. According to a few estimates, the global urban area will be two-to-three times the size it was in 2000 by 2030 under the SRES scenario. We also used a basic urban model to predict urban growth and population density under the SRES and SSP scenarios. Our 2030 projections indicate an increase in urban areas of 1.8–2.4 times under the SRES and 1.9–2.2 times under the SSPs, which are lower estimates than previous research. We predict that by 2050, the urban area will have grown 2.3–3.6 times, and 3–6 times by 2100 [7]. Under most scenarios, the world average population density is expected to fall this century. Even if population rises in most scenarios, the decrease in population density indicates improved mobility and suburbanization, which is accompanied by economic development. Some urban transportation study has shown a negative connection between urban density and transport energy consumption per capita, suggesting a worldwide decrease of 42 M. According to Kii et al., urban population density may increase GHG emissions in the urban transportation sector [8].

Asian cities are important in urban growth for all scenarios when the urban area is divided into regions. Asia's urban regions are projected to account for 40% of global urbanization by 2100. Except for SSP3, it is anticipated that Asia's urban population will peak this century. As a consequence of the ensuing economic development, increased transportation expenses may become more reasonable, leading to suburbanization of residential areas and a decrease in population density [7]. In Africa, however, some forecasts predict greater population increase and weaker economic development. For example, SSP3 depicts a fragmented globe with very high population density, with African cities having an average population density of more than 20,000 people/km2. Due to reduced commute distances inside the city, these cities may produce less GHGs; but, the ultra-high density will create other serious urban issues, such as public health and congestion.

The environment will be impacted by urban development in a variety of ways, including GHG emissions and ecosystem degradation caused by land use change. At the same time, urban growth will have an impact on the city's quality of life as well as the value of its assets and property. Because infrastructure and structures may be used for decades or even centuries, spatial planning and management should take into account future socioeconomic circumstances in the context of climate change. Our study's sensitivity analysis shows that the urban area may vary, even under the same population and GDP scenario, depending on transportation and building costs: as a consequence, overall trip duration varies. When transportation costs fall, the urban area expands. In contrast, when high-rise building construction prices fall, so does the urban area.

This indicates that a policy mix that incorporates transportation and land use may result in eco-friendly urban architectures. More transdisciplinary research is required to understand the viewpoint of interaction between urban activities and climate change. Sustainability science refers to a comprehensive approach to the development of a sustainable society. Sustainability science is a research area characterized by its aim of solving issues rather than by the disciplines it employs. Problems include problems that our civilization has never encountered before, such as sustainable water supply, clean energy, human health, food security, increasing urbanization, environmental and natural resource concerns, poverty reduction, global warming, ecosystem conservation, and biodiversity. Many of us have grown more worried about the complexity and dilemmas that cities face in dealing with these issues. Sustainability science attempts to integrate natural science, social science, and humanities in order to address urgent global problems with a very broad reach. However, attempts toward this fusion are still being explored.

Urban Planning Research in the Age of Climate Change. A transdisciplinary strategy is needed to address the 43 superficial issues. The International Council for Science review panel addressed the notion that the transdisciplinary approach aims not only to transcend barriers across disciplines, but also to generate fusion and to build links with stakeholders beyond academia in order to tackle global issues. Modern urban planning has, by definition, necessitated problem-solving and a multidisciplinary approach. It arose shortly after the industrial revolution, when worries about public health and the industrialization of towns in England started to develop. Since then, planning has advanced by combining knowledge from different disciplines such as architecture, civil engineering, public health, economics, and politics. Currently, urban planning is its own subject that evolved independently from different disciplines such as architecture, civil engineering, and geography. Of course, research into specific issues within the field is required. However, urban planning has a broad variety of societal and environmental consequences. Instead of limiting study to a single field, a transdisciplinary research strategy will be needed to contribute to urban and climate policy for a sustainable future. According to Kajiwara et al. (2014), in 2013, the area of “urban and transportation systems” was the sixth biggest research cluster in sustainability research. Because this area is so intimately linked to nature and civilization, it includes a broad range of cross-disciplinary research issues.

Even if the transdisciplinary method is successful, dealing with issues on many levels at once may overcomplicate the situation, and that effort may not provide any meaningful results. Lee (1973) has previously identified the problem of large-scale models for urban analysis as a policy-making tool. Since then, urban models have been improved by using economic theory to make the process of political effect on society understandable, and such models are now used in the practice of urban policy-making in certain nations. These models depict urban activities based on the locational and travel behaviors of city actors, and they analyze the effect of target policies through the mechanism of urban activities [9]. The urban model may also be used to implement certain urban climate policies; however, the model often needs geographical data from urban activities. As a result, owing to data constraints and model construction costs, it is currently impossible to apply the comprehensive urban model to all worldwide cities for long-term assessment of urban climate policy. For the long-term and worldwide study of the interplay between urbanization and climate change, we require a simple and acceptable model that can be run with less datasets. Furthermore, urban models are needed for the application to other urban issues, such as social exclusion or community development as a result of housing and transportation regulations. These criteria need the development of a more comprehensive and complicated model to depict the interaction of different actors in the city. This social element may also be used to climate policy [10]. As a result, urban model research will take two paths: simplicity in global analysis and complexity in local analysis. Figure 1 discloses the Interaction between Urban Activities and Climate Change.

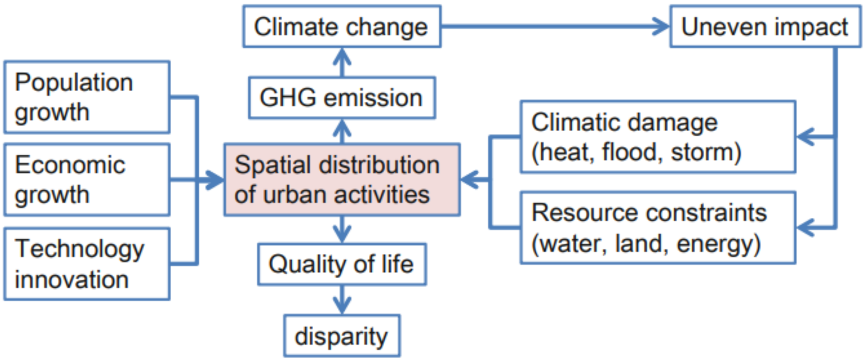

Figure 1: Interaction between Urban Activities and Climate Change.

3. CONCLUSION

We addressed the framework of urban planning research for the co-evolution of climate policy in this essay. We need a microscopic perspective to analyze individual cities, as well as a macro view to understand the effect of global cities on the climate as a whole. When compared to the time scale of traditional urban planning, climate change is an enormously long-term phenomenon. We developed a cross-assessment framework to coordinate societal normative standards in order to guide policy choices on urban and climatic problems. This method is intended to harmonize the many value standards and lead to a common vision and agreement among stakeholders. Climate change and urbanization have a broad range of effects that are influenced by a variety of variables, necessitating a multidisciplinary study strategy to capture the interplay. Sustainability science may be a research area to investigate this relationship. Finally, the connection between technology innovation and urban sustainability was explored. While technology innovation may solve particular issues, how these breakthroughs are coupled with other technologies or urban policy can have a completely different unexpected effect on urban space and life. This implies that technology innovation may help to address urban and climate issues, but only if we have a common vision of the future urban system and agreement among stakeholders.

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