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Urbanization and Climate Change

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ABSTRACT: Rapid urbanization is making people more vulnerable to the impacts of climate change, according to a new UN report that highlights diverse initiatives worldwide that are bolstering the resilience of cities, towns and villages. More than half the world's population today live in cities, and another 2.5 billion people are expected to join them by the future. The frequency of torrential rain and storm surges is on the rise in big, densely populated cities like New York, Mumbai and Jakarta, hitting those living in marginalised, informal settlements like slums the hardest. Desertification swallows arable land needed to feed swelling urban populations. And sea level rise threatens everyone living in coastal areas, delta regions, and small-island countries. To combat these threats to sustainable development, numerous cities have taken steps to build resilience and address the growing climate-related risks posed to inhabited areas. Through initiatives such as 100 Resilient Cities and the Global Covenant of Mayors, leaders of cities have shown commitment to work together to address climate change and its impacts. Support from global organizations such as the World Bank, ICLEI, UN-Habitat, have also made various resources available to policy-makers, practitioners and even individuals willing to take action.

KEYWORDS: urbanization, climate change, impact, population, pollution, sustainable, global warming

I. INTRODUCTION

The authors of the report "Initiatives in the Area of Human Settlements and Adaptation" compiled a summary of some of the most prominent global and regional initiatives that support adaptation and climate resilience in cities, towns and villages. The study is structured around the five opportunities for action offered by those initiatives: learn, access technical support, commit, finance, and unite. The report underscores the diversity of those initiatives, as well as the evolution of the services they have provided over the past decade. Some of the inspiring global and regional initiatives focusing on urban resilience mentioned in the report are:

1. Learn: Urban Climate Change Research Network

A consortium of over 700 scholars and experts dedicated to climate analysis in cities, the Urban Climate Change Research Network has contributed to efforts to increase access to climate knowledge. Based at the Columbia University Earth Institute in New York (USA) since 2007, this global program is committed to support city-level actions through projects such as global reports, an online case study docking station that stores 115 empirical experiences in cities, as well as Regional Hubs.¹

2. Access technical support: 100 Resilient Cities & the Asian Cities Climate Change Resilience Network

The 100 Resilient Cities program was launched by the Rockefeller Foundation in 2013 as a way to select 100 cities to be provided with necessary resources in developing road maps to resilience. Support that has been provided ranges from financial and logistical guidance, expertise in strategy development, access to solutions and service providers, as well as membership to a global network of cities.²

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The Rockefeller Foundation, through a partnership with the European Commission and ICLEI's network of regional secretariats, previously implemented the Asian Cities Climate Change Resilience Network in 50 cities across India, Indonesia, Thailand, Vietnam, Bangladesh, and the Philippines. It shares the 100 Resilient Cities' mission to equip cities in building resilience to the physical, social and economic challenges of the 21st century.

3. Commit: Global Covenant of Mayors for Climate and Energy & the Covenant of Mayors in Sub-Saharan Africa

The Global Covenant of Mayors for Climate and Energy is the largest global coalition of cities committed to climate leadership, comprising more than 7,100 cities from 119 countries. Launched at the beginning of this year, this coalition is a merger between the existing Compact of Mayors and European Union Covenant of Mayors for Climate and Energy.³

At the regional level, the Covenant of Mayors in Sub-Saharan Africa has also been funded by the European Commission in order to increase African cities' planning capacity and provide a platform to share knowledge and best practices.

4. Finance: Sustainable Cities Integrated Approach Pilot

The Sustainable Cities Integrated Approach Pilot is a program of the World Bank that aims to mobilize 1.5 billion over 5 years to support various urban sustainability projects in 23 cities across 11 pilot countries. The program is supported by a grant from the Global Environmental Facility, and will be implemented in partnership with African Development Bank, Asian Development Bank, Southern Africa Development Bank, Inter-American Development Bank, UNEP, UNDP, and UNIDO.

5. Unite: Global Alliance for Urban Crises

Launched at the World Humanitarian Summit 2015, the Global Alliance for Urban Crises seeks to address challenges at the intersection of urbanization, conflict, displacement, and climate change. More than 65 organizations had joined the alliance, with the big goal to ensure that stakeholders can work effectively in towns and cities affected by crisis.⁴

There are fewer initiatives focusing on climate-resilience in smaller towns and villages, particularly in rural and remote areas, but the Cities and Climate Change Initiative (CCCI) is an important example on what is possible:

UN-Habitat's CCCI is an initiative aimed at building the adaptive capacity of cities in developing countries with a focus on "pro-poor" participatory planning. Among others, the initiative supports projects to build resilience in villages in the southern part of Lao People's Democratic Republic, as well as remote settlements such as the Solomon Islands' capital, Honiara.

II. DISCUSSION

Urban areas are major contributors to climate change, accounting for 71 to 76 per cent of CO₂ emissions from global final energy use, and represent high concentrations of financial, infrastructure and human assets and activities that are vulnerable to climate change impacts. In the coming decades, hundreds of millions of people in urban areas are likely to be affected by rising sea levels, increased precipitation, inland floods, more frequent and stronger cyclones and storms, and periods of more extreme heat and cold. In fact, many major coastal cities with populations of more than 10 million people are already under threat as over 90% of urban areas are coastal. Climate change may also negatively impact infrastructure and worsen access to basic urban services and quality of life in cities. In addition, most of the vital economic and social infrastructure, government facilities, and assets are located in cities. The most affected populations are the urban poor – i.e. slum dwellers

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Vol. 5, Issue 11, November 2016

in developing countries – who tend to live along river banks, on hillsides and slopes prone to landslides, near polluted grounds, on decertified land, in unstable structures vulnerable to earthquakes, and along waterfronts in coastal areas. The urban poor is indeed increasingly vulnerable: more than 1 billion people live in slums and informal settlements and are highly vulnerable to climate change. Despite these risks, many cities have not yet addressed climate change. The reasons include a lack of relevant city policies and action plans; existence of regulations on urban planning and environment which have not been adjusted to manage climate change; slow response to climate disasters due to lack of capacity and resources; and lack of public awareness on climate variability and climate change-induced hazard mitigation.⁵

Both climate change and increasing urbanisation, particularly informal development, are likely to negatively impact on water quality of rivers which, in turn, could have significant economic impacts for the communities dependent on these rivers both for direct use, but also indirectly in terms of the water-dependent economic activities such as agriculture. Better understanding of the link between increasing water quality risks due to urban development and climate change and the associated economic impact that this has, is therefore, critical in terms of identifying the need for interventions, improved management and investments in ecological infrastructure to ensure sustainable development and to mitigate against the increasing risks associated with rapid urbanization and climate change.⁶

Urban areas generally exhibit significantly higher air and surface temperatures than their surrounding rural areas, resulting in urban heat islands. However, little has been done to synthesize existing knowledge and identify the key research gaps in this area, particularly in Africa. This paper focuses on the combined effects of urbanization and climate change on the urban thermal environment in Africa, and provides a comprehensive review of results, major advances and the dominant direction of research. Our review of 40 publications from peer-reviewed journals from 2000 to further years revealed that South Africa, Ethiopia and Nigeria were most frequently studied, and satellite imagery-based data and analysis were used predominantly. Results from a few studies have shown the practical implications for urban land-use planning, informal settlement management, human wellbeing and productivity, energy use, air pollution and disease spread. Integrated approaches, strengthening planning institutions, and early warning systems are proposed to address climate change. Low-income groups are emphasized in efforts to help people cope with heat stress. Solutions based on land use and land cover dynamics and blue-green infrastructure are mentioned but are in need of further research. Cities with similar patterns of urbanization, geographies and climate conditions could benefit from multi-disciplinary research collaboration to address the combined impacts of rapid urbanization and climate change.⁷

Urbanization has profoundly affected the environment and climate all over the world and has intensified the climate change impacts. The aim of this research is to study of effects of urbanization as the most suspicious factor of climate change in a holistic view applying system dynamics approach. An introduction to urbanization and climate change as an obstacle to sustainable development will be presented in general. Then, in particular, Tehran metropolis is described, since the city is an excellent example of the issue. In this regard, the focus will be on complexity of such dilemma. Then, system dynamics approach (SDA) that can play a key role in solving these kinds of problems will be introduced. Furthermore, the prototypes of the system are recognized. Finally, management practices and solutions of the problem are presented. The effects of urbanization will be reviewed in a new approach which has not been applied in previous studies. The involving mechanisms in this process are recognized. “Fixes that fail,” “success to the successful,” and “tragedy of commons” are the most prevalent prototypes in the system based on which solutions are presented.⁸

Climate change, which is mainly caused by carbon emissions, has attracted attention worldwide. With the continuous increase in temperature, the urban heat island effect, extreme weather, and water shortages have seriously affected the urbanization process. Through an empirical analysis of panel data from 28 provinces in China from 2006 to further, this study examines the impact of climate change-induced temperature changes on the urbanization of China’s population. The

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Vol. 5, Issue 11, November 2016

results show that the urbanization level has a significant double-threshold effect on the impact of temperature on urbanization. When the urbanization level crosses the corresponding threshold value, the negative impact of temperature on urbanization is relatively weak. Understanding the impact of climate change on urbanization has become increasingly important as climate warming increases. On the one hand, the climate issue has always been a topic of common concern around the world. On the other hand, studying how climate change affects population urbanization is conducive to identifying the human factors that affect climate change and proposing corresponding solutions. Simultaneously, it also provides a reference for optimizing the distribution of urban and rural populations, and can comprehensively consider the relationship between climate change and urbanization in the formulation and implementation of policies. On this basis, the Chinese government should strengthen financial support for climate change, play a leading role in policies, improve the urban layout and structure, and increase the resilience of cities to climate change.⁹

III. RESULTS

Urban areas account for more than 70% of CO₂ emissions from burning fossil fuels. Urban expansion in tropics is responsible for 5% of the annual emissions from land use change. Here, I show that the effect of urbanization on the global carbon cycle extends beyond these emissions. I quantify the contribution of urbanization to the major carbon fluxes and pools globally and identify gaps crucial for predicting the evolution of the carbon cycle in the future. Urban residents currently control ~22 (12–40)% of the land carbon uptake (112 PgC/yr) and ~24 (15–39)% of the carbon emissions (117 PgC/year) from land globally. Urbanization resulted in the creation of new carbon pools on land such as buildings (~6.7 PgC) and landfills (~30 PgC). Together these pools store 1.6 (±0.3)% of the total vegetation and soil carbon pools globally. The creation and maintenance of these new pools has been associated with high emissions of CO₂, which are currently better understood than the processes associated with the dynamics of these pools and accompanying uptake of carbon. Predictions of the future trajectories of the global carbon cycle will require a much better understanding of how urban development affects the carbon cycle over the long term.¹⁰

Green Yodha is a sustainability initiative by Schneider Electric that aims to build a community of conscious citizens, businesses, and institutions to unite for a collective action towards the adoption of practices in energy efficiency, renewables and solar, automation, digitalization, and a new world of electricity to meet both individual and corporate sustainability goals.

Organizations all over the world are accelerating climate action programmes and are putting them on top of their corporate agendas. Do not stay behind and let us become your partner on the way to a net zero carbon future. Our mission is to be your digital partner for Sustainability and Efficiency. Our energy and sustainability experts help turn energy into a controllable spend across companies, homes, buildings, data centers, infrastructure, and industries. We integrate market-leading process and energy technologies; endpoint to cloud linking devices, controls, software, and services across the lifespan. We are advocates of open standards and partnership ecosystems to unleash the infinite possibilities of a global, innovative community that is passionate about our shared Meaningful Purpose, Inclusive and Empowered values. Sustainability is no more about doing less harm, rather it's about doing more good. When you incorporate the most effective social and environmental initiatives across all business channels, you open roads to new opportunities to save the planet. At Schneider Electric India, we want to develop and expand our dedication to sustainability such that it benefits both our enterprise and the communities we do business with.¹¹

The manufacturing sector is no exception when it's about the emission of greenhouse gases. Waste elements from the manufacturing industries can be harmful for humans. As a result, a push has been made to urge firms to alter their production techniques. This is simply because of how people are growing conscious each day about the environment

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they're living in. As a result, companies are aware that their business line may be impacted if they fail to incorporate more sustainable production techniques since consumers greatly demand eco-friendly products.

Let us take a closer look at what exactly are the measures that fall under green manufacturing & sustainable manufacturing practices that follow thereafter:

1. The goal of green manufacturing is to consume less energy and raw materials. Spending can be cut while still helping the environment by lowering energy use and material waste. This offers the chance to manufacture more goods more effectively, eliminate waste from processes and secure the company's financial position.
2. The green workforce develops together with green manufacturing. Business and societal value are driven by the desire for sources of innovation and connective roles.
3. Employees want to work for a business where they feel safe and proud of a green business. Employees who work in improper production environments are exposed to indoor air pollution, which can have a negative impact on their health and occasionally lead to chronic illnesses. Employees are motivated by a corporation that cares about the world and their community; green workspaces experience a considerable increase in productivity.¹²

IV. CONCLUSIONS

Cities are on the front lines of the growing physical risks associated with climate change. They are home to more than half of the world's people, and by 2050, that figure is projected to rise to 68 percent.² Urban areas are often located in places of particular climate risk, such as on coastlines, floodplains, and islands. Moreover, modern urban infrastructure and its operating systems are closely connected. A failure in one part of a network can affect another, multiplying the damage. Flooded roads, for example, can damage links to public transport. Storm surges and extreme heat can lead to power outages that knock out the technology systems critical to homes, hospitals, and industries. Given existing greenhouse-gas emissions, some climate change is already locked in, making such risks unavoidable. To protect the lives and livelihoods of urban residents, the imperative is to adapt—and to start now. Climate change could increase the severity and frequency of extreme heat, flooding, drought, and wildfires—the specific hazards addressed in this report. More than 90 percent of all urban areas are coastal; by 2050, more than 800 million urban residents could be affected by sea-level rise and coastal flooding. In addition, 1.6 billion people could be vulnerable to chronic extreme heat (up from 200 million today), and 650 million could face water scarcity.¹³

Because different cities face different climate risks and have varying levels of vulnerability, adaptation options that are effective in most may not be feasible in others. To manage that complexity, cities can concentrate on actions that play to their strengths (in resources, physical features and assets, and jurisdictional control) and offer a high return in risk reduction. Identifying such high-impact adaptations can be daunting, given the steadily developing nature of the climate threat and the dizzying array of adaptation options available. This report, cowritten with C40 Cities Climate Leadership, a network of large cities that are committed to addressing climate change, seeks to help leaders set priorities and choose courses of action. It identifies a starting list of 15 high-potential actions that can work for many types of cities. The actions were chosen on the basis of three main sources: C40 Cities Climate Leadership and McKinsey analysis, consultation with adaptation experts and city leaders, and an extensive literature review.

There are two parts to the report. The first sets out the 15 actions. Four of them build systemic resilience, meaning they strengthen all kinds of cities. The other 11 are hazard specific, meaning they target particular physical climate risks. Some of the 15 actions, such as building barriers to protect coastal areas and retrofitting infrastructure, are complex and

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

expensive. Others, such as planting trees next to streets and initiating behavioral-change programs to conserve water, aren't. Examples from all over the world, in both advanced and developing economies, demonstrate what's possible. The second part of the report describes, in broad terms, how cities can implement the actions. We suggest that they begin by defining the most relevant hazards and by understanding the risks those hazards pose to their communities. On that basis, cities can then conduct detailed analyses of the risk-reduction impact, costs, and feasibility of different actions. Several important themes emerge from the research. First, nature-based solutions—such as planting trees next to streets, river-catchment management, and sustainable urban-drainage solutions—are among the most attractive actions because of their impact on reducing risks and their feasibility. Nature-based solutions also often provide benefits beyond adaptation in areas such as decarbonization, economic growth, and health. Second, cities can invest in actions that increase resilience systemically, in addition to adapting to specific and immediate hazards. Systemic resilience includes increasing awareness of physical climate risks, incorporating risk awareness and preparedness into city processes, optimizing emergency responses, and enhancing financial and insurance programs.¹⁴

Third, there's an important equity element to climate-risk adaptation. Vulnerable populations, such as children, the elderly, low-income communities, some minority groups, people with disabilities, and women, may be at higher risk for climate-related damage. For example, continued rapid urbanization is leading to increased populations in informal settlements. They often lack the resources and adaptive capacity to withstand major events, such as floods and extreme heat. Climate risk directly affects people (health, livability, and workability), assets (businesses, homes, and hospitals), and services (energy and food supply). This report can serve as a starting point to help cities develop their agendas for adaptation. Leaders will need to go deeper as they work out their strategies. Local knowledge is critical to success. At the same time, climate adaptation is one of many competing priorities, and urban resources are limited. By identifying the most effective and feasible actions, cities can focus on executing them well and build momentum to do more. This report is a call to action—focused action. We hope that it will help cities play an important role in making swifter, surer progress toward a healthy and sustainable future.¹⁵

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