

Current Studies

**Science
Technology
Innovation**

Science, technology and innovation for sustainable urban development in a post-pandemic world



**United
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This series of publications seeks to contribute to exploring current issues in science, technology, and innovation, with particular emphasis on their impact on developing countries.

The term “country” as used in this study also refers, as appropriate, to territories or areas. In addition, the designations of country groups are intended solely for statistical or analytical convenience and do not necessarily express a judgment about the stage of development reached by a particular country or area.

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1. Introduction

The world is far from attaining resource-efficient, safe and inclusive urban areas,¹ where anyone can benefit from environmentally friendly and prosperous economies and high-quality public goods and services. At its sixteenth session, in 2013, the United Nations Commission on Science and Technology for Development examined the theme of science, technology and innovation (STI) for sustainable cities and peri-urban communities, including environmental sustainability. Since then, accelerating technological change in renewable energy, artificial intelligence, machine learning and big data have opened new possibilities for addressing urban problems innovatively, at a lower cost and more sustainably.

The international landscape in which STI and urban development policies interact has also changed since 2013, with the adoption of the following: Sendai Framework for Disaster Risk Reduction 2015–2030; Addis Ababa Action Agenda of the Third International Conference on Financing for Development; 2030 Agenda for Sustainable Development, in particular Sustainable Development Goal 11; Paris Agreement under the United Nations Framework Convention on Climate Change; and New Urban Agenda adopted by the United Nations Conference on Housing and Sustainable Urban Development (Habitat III).² Sustainable urban development, as framed by Sustainable Development Goal 11, invites the international community to rethink urban development patterns and to make urban settlements more inclusive, productive and environmentally friendly.

In addition to accelerating technological change and a new international landscape, the coronavirus disease (COVID-19) pandemic and its effects on urban life provide a third strong reason for the Commission to take a fresh look at the issue of urban development and its social, economic, and environmental dimensions. Accounting for an estimated 90 per cent of all reported COVID-19 cases, urban areas have become the epicentre of the pandemic (United Nations, 2020a), and this can have significant negative effects along all dimensions of sustainable development.

On the other hand, the pandemic has shown the importance of STI systems in contributing to equipping society with the instruments and capabilities required to direct innovation efforts towards improving sustainable urban development and the resilience of urban systems. Scientific knowledge production processes, digital technology adoption and innovations in organizational and institutional settings have contributed to mitigating the impact of the pandemic, helping many urban socio-technical systems to continue to function during the crisis.

As a result, the world has gained access to a rich variety of STI solutions, both technological and non-technological, to urban sustainability issues. These innovative solutions help shape the evolutionary patterns of urban socio-technical systems and contribute to fixing unsustainable urban operations, including economic activities.

The publication is structured around four chapters. Chapter 2 presents the most pressing challenges to sustainable urban development in a post pandemic world. Chapter 3 discusses in depth the contribution that STI practices make towards mitigating these challenges. Chapter 4 presents conclusions and policy recommendations.

¹ Definitions of urban, peri-urban, and rural areas differ significantly in the literature and among countries. These differences usually relate to minimum population sizes and density, and they make it difficult to agree on universal definitions. In this paper, the terms urban area and its synonyms – such as urban environments, urban settlements, urban communities, urban systems, urban regions and urban territories – are used interchangeably, and they cover all degree of urbanization and types of urbanized territories, from the more densely populated urban areas of cities and towns to the intermediate and less dense urban areas that create the urban–rural continuum of peri-urban spaces. Peri-urban spaces are composed of both urban and rural areas; they form urban–rural interfaces and may gradually evolve into fully urban territories, but their growth is fragmented and involves relatively sparse and discontinuous land use patterns.

² See, respectively, United Nations General Assembly resolutions 69/283, annex; 69/313, annex; and 70/1, annex; United Nations Framework Convention on Climate Change, FCCC/CP/2015/10/Add.1, annex; and General Assembly resolution 71/256, annex.

2. Challenges of sustainable urban development

People live in a highly urbanized world. In 2017, urban areas were home to more than 4 billion people,³ and this event has become an important milestone in the history of humanity; for the first time, the worldwide share of urban population has outnumbered the rural population (United Nations, Department of Economic and Social Affairs, 2019a). The urbanization process is considered as one of the main demographic trends, alongside with population growth, population aging and international migration.

During the last two centuries, an overall reduction in human fertility levels has been registered almost worldwide. As a result of this trend, the absolute size of the world's population is expected to grow continuously over the next decades, but at a slower pace compared to the pre-1950 scenario, moving from the 7.7 billion recorded in mid-2019 to 8.5 billion in 2030 and almost 10 billion in 2050 (United Nations, Department of Economic and Social Affairs, 2019b). Notwithstanding the reduced growth pace, urban areas will continue to expand and absorb most of this future population growth.

Two thirds of the worldwide population are expected to live in urban areas by 2050 (World Bank, 2021). In 2020, most of the population was still rural only in a few low-income and lower-middle-income countries – mainly located in Central Africa and South Asia. In many middle-income countries across Eastern Europe, East Asia, Africa and South America, between 50 per cent and 80 per cent of the population was already living in urban environments, and the percentage went above 80 per cent in most high-income countries across Australia, Japan, the Americas, the Middle East and Western Europe (Ritchie and Roser, 2019). Moreover, in addition to being among the most highly urbanized regions in the world, Asia and Africa are also expected to urbanize fastest in the coming decade and to accommodate the largest numbers of new urban dwellers (World Bank, 2021). As a result of these variations within and across regions, dissimilarities appear in urban sustainability implications, which expose the coexistence between local and global dimensions of sustainable urban development.

Moreover, while the populations of many urban areas continue to expand, other urban areas are affected by urban shrinkage, a phenomenon that has become global. However, because urban shrinkage and urban population growth are two very localized events, they can manifest together within the same town, city, or macro-region. For example, the most notable and rapid increase in urban population is expected in Africa and Asia, but cases of urban shrinkage have been spotted in some macro regions of China, India, Japan and the Republic of Korea (Pallagst et al., 2021; Richardson and Nam, 2014). Shrinking towns and cities – and sometimes neighbourhoods (Schenkel, 2015) – are also appearing in Europe and North America (Gao and Ryan, 2020; Richardson and Nam, 2014). For example, urban shrinkage has affected the structural configuration of cities such as Schwedt and Dresden in Germany, Glasgow in Scotland (United Kingdom), and Buffalo and Pittsburgh in the United States of America.

Regionally differentiated patterns also appear when observing the dynamics of population aging. The share of older population – individuals aged 65 years or more – has increased globally over the last three decades, and it is expected to double by 2050 (United Nations, Department of Economic and Social Affairs, 2019c). However, global aging remains a more local issue. The uneven distribution of elderly populations causes variations in this general prediction; more impact is forecasted in regions such as sub-Saharan Africa, whereas only relatively modest changes are expected in European cities (Sivaramakrishnan, 2018).

³ In producing this estimate, the Department of Economic and Social Affairs of the United Nations examined urbanization trends in 1,900 urban settlements with 300,000 inhabitants or more.

The global scale and the pace of urbanization trends bring unprecedented challenges, whose implications deeply affect the configuration of urban systems and their functioning. The COVID-19 pandemic has also highlighted the challenges facing urban areas, which have become the locus of crucial urban sustainability lessons that country leaders, local authorities, and other urban development actors should take into consideration.

Box 1

The COVID-19 pandemic and sustainable urban development

Urban areas have become the epicentre of the COVID-19 pandemic, where the quality of life has been severely damaged by the devastating effects that the pandemic has caused. For many cities the COVID-19 pandemic has started as a health crisis but has subsequently expanded into “a crisis of urban access, urban equity, urban finance, safety, joblessness, public services, infrastructure and transport” (United Nations, 2020a). Urban areas have become the physical space in which COVID-19 has worsened existing deep-rooted inequalities caused by gender, age and place of residence. Meanwhile, social care systems have left older individuals and those affected by mobility issues isolated, with no opportunities for social interaction, and housing systems with informal settlements have left their residents exposed to a higher risk of virus transmission due to overcrowded and unhealthy living conditions.

The responses of government leaders to the pandemic have introduced drastic social distancing and lockdown measures, which have modified patterns of energy and transport demand worldwide. Although only temporarily, these measures have led to a significant reduction of greenhouse gas emissions (Le Quéré et al., 2020) and some air pollutants (Streiff, 2020) in many urban areas. These indirect effects of the COVID-19 pandemic have demonstrated that a greener urban future is possible. However, other pressing environmental challenges have been exacerbated, showing the need for more innovation in urban socio-technical systems. For example, the intense use of disposable plastics has led to a significant increase of urban plastic pollution and inappropriate waste management practices (Adyel, 2020).

The devastating impact of COVID-19 on economy has generated business closures and jobs losses worldwide, especially in least developed and developing countries. As a result, existing economic inequalities have been exacerbated and the level of poverty has increased, especially for families relying on informal economic activities. For example, the economic hardship has pushed millions of informal workers in developing countries out of urban areas due to their impossibility to afford the provision of basic urban services, including housing (United Nations Human Settlements Programme (UN-Habitat), 2020). Moreover, populations who are affected by a higher incidence of extreme poverty will also be the most exposed to the long economic fallout of the pandemic.

The pandemic has exposed the incapability of many urban settings to deliver on the expectations of disaster and risk management for urban resilience and sustainability. Many urban socio-technical systems have fallen under the pressure, leaving people and places behind, and this result clashes with the core principles of inclusivity and social justice that urban sustainable development champion.

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