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Sustainable Cities

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ABSTRACT

By nature, humans are social creatures and thrive in urban spaces that foster social connections. Cities are essential to sustainable development since they are the center of economic development. They interact extensively with surrounding and with the rest of the world. The sustainable city concept focuses on improving the conditions of the urban areas in order to create healthy, pleasant, livable, inclusive, safe, and resilient cities where residents want to live and work. This chapter provides an introduction on sustainable cities.

KEYWORDS: *sustainability, sustainable cities, smart cities, green cities*

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INTRODUCTION

Today, people are living longer than ever before. The sheer number of people who live in cities now is massive. The majority of the world is now urban and the world is becoming increasingly urbanized. Half of the world's population (3.5 billion people) now lives in cities. By 2050, it is predicted that 70 per cent of the world population will be in urban settlements. This rapid urbanization is exerting pressure on fresh water supplies, sewage, living environment, public health, traffic, waste production, and overall quality of life. It is resulting in a growing number of slum dwellers, inadequate, and overburdened infrastructure, uncontrolled urban growth, congested traffic, a worsening air pollution, environmental degradation, inadequate urban infrastructure, and a lack of basic services, such as water supply, sanitation, and waste management, all of which increase the vulnerability of cities to natural disasters [1]. Balancing the immediate needs of today without sacrificing the demands of tomorrow is at the heart of sustainability.

Cities are increasingly connected to each other economically, socially, and culturally. Although each city is unique, they share a great number of common expectations. Megacities typically concentrate large proportions of the economic, environmental, and human resources of their nations. Human capital development, attractions of sustainable living standards, and renewed concerns for the planet have refocused city planners to a new frontier: the creation of sustainable cities [2].

WHAT ARE SUSTAINABLE CITIES?

The idea of sustainable cities came out of an understanding of the importance of individual human behavior. Sustainability is often defined as meeting the needs of the current generation without compromising the ability for future generations to meet those same needs. To achieve sustainability, we must think about how to implement it in all facets of life: buildings, streets, parks, roads, sidewalks, etc. Cities are key to sustainable development and sustainable future. They are responsible for making policies that affect sustainability.

A sustainable city, also referred to as an eco-city, is a city designed with consideration for the triple bottom line: social, economic, environmental impact, as illustrated in Figure 1 [3]. It is one in which its people and businesses continuously endeavor to improve their natural, built, and cultural environments. For a city to be sustainable, all of those parts must be sustainable as well. Thus, sustainable city must have sustainable shelter markets, sustainable development, sustainable transport, sustainable agriculture, sustainable livelihoods, sustainable resource use, sustainable water supply, sustainable production/manufacturing, sustainable energy use, etc.

Socially sustainable cities should be equitable, diverse, inclusive, connected, democratic, and provide a good quality of life. While creating sustainable living conditions for all its inhabitants, a sustainable city should also promote economic growth and meet their basic needs. Sustainable cities should promote sustainable developments and encourage people to live in a more sustainable and environmentally-friendly way. They facilitate economic production and consumption processes while reducing our impact on the natural world.

The main characteristics of a sustainable city include [4]:

- It introduces greenery into the urban environment to reduce CO2 emissins and improve the quality of its air.
- It promotes renewable energies to conserve and protect natural resources.
- It successfully implement sustainable mobility and the use of public transport, and is committed to a circular economy.
- It will grow at a sustainable rate and use resources in a sustainable way.
- Resources and services in the city are accessible to all.
- Public transport is seen as a viable alternative to cars.
- Public transport is safe and reliable.
- Walking and cycling is safe.
- Wherever possible, renewable resources are used instead of non-renewable resources.
- Waste is seen as a resource and is recycled wherever possible.
- There is access to affordable housing.
- Community links are strong and communities work together to deal with issues such as crime and security.

Smart sustainable cities (SSC) is an aggregate concept that combines smart cities and sustainable cities, as shown in Figure 2. Cities can be made sustainable without the use of smart (ICT) technology, and smart technologies can be used in cities without contributing to sustainable development [5]. A smart sustainable city is an innovative city that uses ICTs and other means to improve quality of life, efficiency of urban operation and services and competitiveness. ICTs can leverage artificial intelligence (AI) and other technologies to further our understanding of urbanization, thereby providing useful information to tackle urban challenges and minimize climate risks.

Another concept related to cities is "green growth," which refers to economic growth that not only preserves but enhances the inherited natural resources. A green city is a city that is focused on sustainability. Building a green city is somewhat equivalent to the building of sustainability [6]. Green spaces are increasingly becoming part of the efforts to promote sustainability because of the different areas of benefits they provided. Implementing green policies at the local level typically confronts some problems.

SUSTAINABLE DEVELOPMENT GOALS

Nations and organizations worldwide have determined to work together and achieve the United Nations' Sustainable Development Goals (SDGs). United Nations Environment Programme (UNEP) assists member states and organizations to achieve relevant SDGs on cities including SDG 11 (sustainable cities and human settlements). The SDG 11 defines sustainable cities as those that are dedicated to achieving green sustainability, social sustainability, and economic sustainability. Sustainable development goals (SDGs) are regarded as extension of Millennium Development Goals (MDGs) and a post-2015 agenda to fight against poverty and eradicate human deprivation [7].

The 2030 Sustainable Development Agenda is applicable to all nations and goes well beyond the MDGs. The Sustainable Development Goals (SDGs) comprise a broad range of economic, social, and environmental objectives, and offer the prospect of more peaceful and inclusive societies. They comprise of 17 goals and 169 targets. The goals are illustrated in Figure 3 [8] and stated as follows [9]:

1. End poverty in all its forms everywhere.
2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3. Ensure healthy lives and promote well-being for all at all ages.

4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. Achieve gender equality and empower all women and girls.
6. Ensure availability and sustainable management of water and sanitation for all.
7. Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10. Reduce inequality within and among countries.
11. Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. Ensure sustainable consumption and production patterns.
13. Take urgent action to combat climate change and its impacts.
14. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17. Strengthen the means of implementation and revitalize the global partnership for sustainable development.

While poverty eradication and food security remain priorities, the Sustainable Development Goals (SDGs) comprise a broad range of economic, social, and environmental objectives. In contrast to the MDGs, the SDGs are uniformly applicable to all countries of the world, removing the "developing" versus "developed" dichotomy that left the MDGs open to criticism. Critics of the new SDGs complain that the goals are too many. As illustrated in Figure 4, partnerships among governments, private sector, and other civil society groups can help achieve sustainable lifestyles and spur new businesses with additional jobs focusing on green technologies and environmental services [1].

CREATING SUSTAINABLE CITIES

Sustainable cities reduce the environmental impact and increase resilience through various means including [10]:

- Urban farming is the process of growing and distributing food, as well as raising animals, in and around a city. This reduces the distance food has to travel from field to fork.
- Renewable energy sources, such as wind turbines, solar panels, or bio-gas created from sewage to reduce and manage pollution.
- Various methods to reduce the need for air conditioning (a massive energy demand), such as planting trees and lightening surface colors, natural ventilation systems, an increase in water features, and green spaces equaling at least 20% of the city's surface.
- Improved public transport and an increase in pedestrianization to reduce car emissions. This requires a radically different approach to city planning, with integrated business, industrial, and residential zones.
- Optimal building density to make public transport viable but avoid the creation of urban heat islands.
- Green roofs alter the surface energy balance and can help mitigate the urban heat island effect. Incorporating eco roofs or green roofs in your design will help with air quality, climate, and water runoff.
- Zero-emission transport
- Zero-energy building
- Sustainable urban drainage systems or SUDS in addition to other systems to reduce and manage waste.
- Solutions to decrease urban sprawl, by seeking new ways of allowing people to live closer to the workspace.
- Educating residents of cities about the importance and positive impacts of living in a more sustainable city.
- Policy and planning changes to meet the unmet demands for urban services (water, energy, transport).
- A building should become LEED (Leadership in Energy and Environmental Design) certified. LEED recognizes whole building sustainable design by identifying key areas of excellence including: Sustainable Sites, Water Efficiency,

Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Locations & Linkages, Awareness and Education, Innovation in Design, Regional Priority.

- Sustainable transportation attempts to reduce a city's reliance and use of greenhouse emitting gases by utilizing low environmental impact vehicles. Poor transportation systems lead to traffic jams and high levels of pollution.

EXAMPLES OF SUSTAINABLE CITIES

The Arcadis Sustainable Cities Index ranks 100 global cities on three sustainability factors or pillars:

- **Profit:** The profit factor measures the value of real estate and the ease of starting and running businesses.
- **People:** The people index focuses on the living standard of the people, literacy, education, and health.
- **Planet:** The planet factor focuses on transportation, water, sanitation, air pollution, and carbon emission among other factors.

Here we consider some examples of ranked cities that have become leaders in sustainable development [11-13].

1. San Francisco, California:

Focusing on technologies to improve energy efficiency in buildings and enhance its transportation system has made San Francisco a leader in sustainability. San Francisco came out tops when measured against key performance indicators across five categories: environmental quality, economic security, governance and empowerment, infrastructure and energy, and social well-being. San Francisco and the surrounding Bay Area constitute a home to highly innovative companies in the world, such as Salesforce, Uber, and Twitter. Its streets are known for hybrid-electric buses and light rails with zero-emission. Advances in sustainable food, recycling, and composting will help San Francisco reach its goal of becoming zero waste by 2020. The local authorities are pushing forward bans on certain products that are causing damage to the environment.

2. Copenhagen, Denmark:

This is one of the cities leading the sustainable revolution. This is often ranked as one of the greenest cities on the world. Copenhagen has focused on reducing energy consumption, reducing emissions, improving the health of its residents, integrating transport, and building "super cycle highways."

3. Vancouver, Canada:

Most cities in Canada have sustainability action plans which are easily downloaded from city websites. Vancouver is regarded as a perfect city to visit and live in due to its surroundings of ocean, forest and mountains. It is determined to be one of the greenest and most climate change resilient cities on earth. In 2002, Vancouver released the Greenest City Action Plan, which set 10 goals to be achieved by 2020. The goals include increasing green jobs, reducing community-based greenhouse gas emissions, and expanding green buildings around the city, getting 100 percent of its energy (including electricity, heating, cooling, and transport) from renewable sources by 2050, and striving for zero waste.

4. Singapore:

This is the most sustainable city in Asia and the second in the world overall. The city-state is also dubbed "the garden city;" it has a population of roughly five million people. It is a self-governing city-state and an island nation. It has developed a Sustainable Development Blueprint with the goal of improving energy efficiency, ensuring its buildings are certified green, and having households live within a 10-minute walk to a train station. Singapore has also improved its sustainability by building effective public transportation systems, which has helped reduce pollution and crowding on streets. The government has focused on improving mobility and connectivity within the city.

5. Adelaide, South Australia:

The city launched an urban forest initiative in 2003 to plant 3 million native trees and shrubs by 2014 on 300 project sites include parks, reserves, transport corridors, schools, water courses, and coastline. The local government launched an initiative for Adelaide to lead Australia in the take-up of solar power. The government also embraced a Zero Waste recycling strategy. In the 1970s container deposit legislation was introduced. In 2010 Zero Waste SA was commended by a UN Habitat Report entitled "Solid Waste Management in the World Cities."

6. Cape Town, South Africa:

This city has been performing exceptionally well from an eco-friendly perspective and has made it to number seven on this list. It is one of the most innovative cities as far sustainability is concerned. The city has set an aim to get 10% of its energy from renewable sources and have 10% of homes running on solar energy by 2020.

7. Frankfurt, Germany:

This is the financial hub of Germany, hosting the European Central Bank. In 2000, Frankfurt committed to becoming the most sustainable city on Earth. Frankfurt has also been an eco-city for years. Frankfurt has been crowned with a major green belt

that is home to 200,000 trees. Over 52% of Frankfurt is covered by open green spaces like water bodies, woodlands, and parks. The local government has a concrete plan for nature and water conservation, energy efficiency, and climate protection. Figure 5 shows the city-state of Frankfurt [14].

The other ranked cities include London, Amsterdam, Hong Kong, Sydney, New York, Los Angeles, Chicago, Zurich, Seoul, Frankfurt, and Dubai.

BENEFITS

Cities are engines of economic growth that have lifted millions from poverty. They offer an opportunity to integrate operations of systems of water, energy, transport, health, education, and security services. Although cities are often characterized by stark socioeconomic inequalities and poor environmental conditions, they also offer growth and development potential. Urbanization has facilitated economic growth through productivity gains in the use of labor and capital. By concentrating people and economic activities, cities have some unique advantages. They have been the drivers of the economy and have lifted millions out of poverty. Many nations are adopting sustainability practices, as evident in new sustainable cities initiatives that are being launched.

Sustainability of cities requires that the living conditions and activities within urban areas are "sustainable," i.e. sustainable shelter markets, sustainable development, sustainable transport, sustainable agriculture, sustainable livelihoods, sustainable resource use, sustainable water supply, sustainable production/manufacturing, sustainable energy use, etc. [11]. The priorities of a sustainable city include the ability to feed itself and the ability to power itself with renewable sources of energy. If managed well, sustainable cities can become drivers of the economy, contributing to local livability, global environmental benefits, and global public goods. They will promote the use of public transit, walk ability, and biking which would benefit citizens' health and the environment. They should also promote a great people climate that appeals to individuals and families of all types and create conditions under which humans can prosper [2].

CHALLENGES

Despite the progress made on sustainable development, many challenges still exist that might hinder the SDG11 implementation process. Sceptics are of the opinion that there is little that a single city can do to achieve sustainability. There is no certainty about what sustainable cities might mean in practice. Maintaining economic growth, while creating sustainable livable cities for all, is the biggest urban challenge in most nations. Cities are finding it difficult to be livable and economically strong. Cities around the world are not balancing the pillars of sustainability. No city has truly balanced people, profit, and the planet. Implementing solutions to the problems of urbanization and achieving urban sustainability requires large amounts of capital, exceptional managerial skill, and significant alignment of interests. Many corporations and investors assume that fixing cities is the responsibility of government, but governments around the world are stuck—financially, politically, or both. In spite of the good done by groups and individuals in favor of a better world, deterioration at all levels continues to increase at alarming rate.

CONCLUSION

Cities are regarded as the engine of economic growth. It plays a critical role for sustainable development. The concept of sustainable city is a relatively recent and has gained attention in the international community. However, the impacts of human activities in cities are increasing and causing great deal of environmental, social, and economic challenges both at local and global levels.

Sustainable cities have been the leading paradigm of urbanism. To be truly sustainable, a city must be sustainable in all areas. Some cities seem to take the notion of sustainability more seriously than others [15]. For more information about general intelligence, one should consult the books in [16-36] and the following related journals:

- Sustainability
- Sustainable Cities and Society
- Sustainable Development
- International Journal of Urban Sustainable Development

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Figure 1 Sustainable development [3].

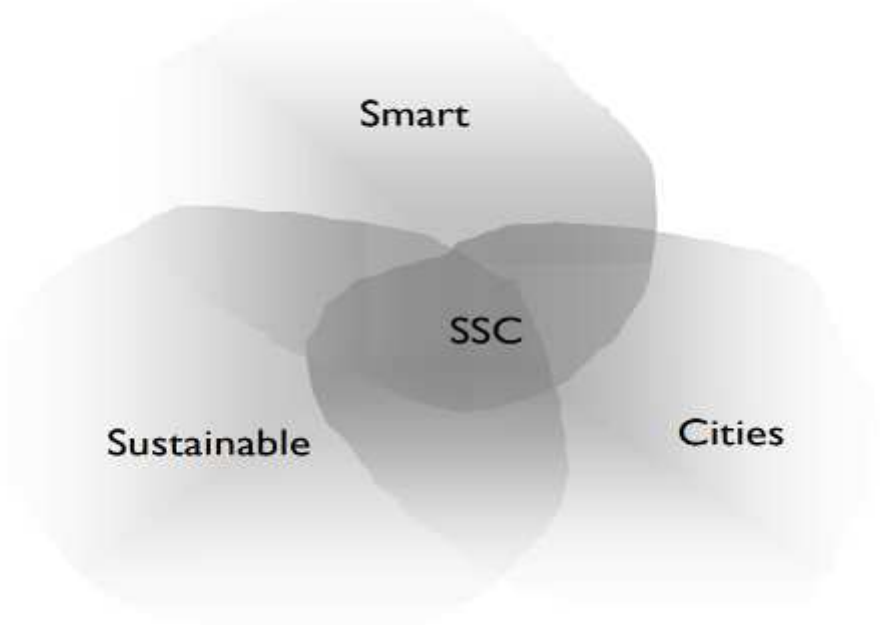

Figure 2 Smart sustainable cities (SSC) [5].

Figure 3 Seventeen Sustainable Development Goals [8].

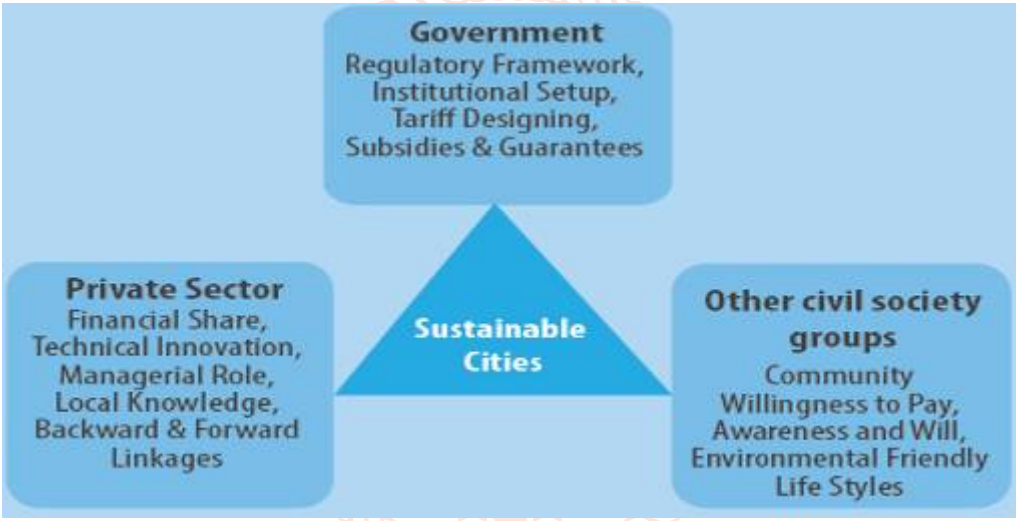

Figure 4 Partnership in developing sustainable cities [1].

Figure 5 The city of Frankfurt [14]