

Challenges and opportunities for Eco-cities & Sustainable Urbanism

Safaa ABOBAKR* & Tarek SAAD *

ABSTRACT

60% of the world's population will move to cities by 2030, and 95% of this urban expansion will occur in developing countries, which increases the level of exposure to unexpected risks for our future cities if it is not planned. This paper aims to discuss environmental resilience and creative transformation in general and sustainable urbanism in particular, referred to in Goal 11 of the Sustainable Development Goals (Transforming Our World). This paper deals with challenges and opportunities for sustainable urbanism & eco-cities to identify the role of technology to achieve resilience for future cities. Therefore, first: studying the new sustainable urbanism, including the impact of climate change on sustainable urbanism and its challenges and opportunities. Second: studying the concept of eco-cities, third: developing a future vision for sustainable cities in our world today.

Key words: Environmental resilience, Creative transformation, sustainable urbanism, Eco-cities, future cities Resilience

Introduction

Since 2007, more than half of the world's population has been living in urban areas and the figure is estimated to exceed 70 % by 2050. Populations lived and worked primarily in rural areas⁽¹⁾ But, it is expected that most of the world's areas would be urbanized by 2050, especially, urbanization is creating greater pressure on limited resources. Already, cities consume more than 75% of the natural resources available globally. This will be accompanied by increased demand for natural resources – particularly water, energy, and

food – creating stresses as vital municipal services and systems come under increasing pressure.

The importance of this study draw features for better future cities in the different domains, ", by focusing on the reality of the relationship between new sustainable urbanism and eco-cities in the presence of digital transformation technology, emphasizing the dynamics of this rapidly changing relationship.

The study adopts the approach of ecological urbanism technology (Eco-Urban-

* Housing and Building National Research Center (HBRC),
Architecture and Housing Research Institute, Cairo, Egypt

Tech), which is based on the transformation to sustainability and the creation of eco-cities, by combining the two directions and using materials from the earth, and running digital technology to achieve resilience for future cities providing possibilities for recycling and reuse, and employing renewable energies positively.

Methodology

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1- New Sustainable Urbanism

Aspects of environmental, economic, and social sustainability concerning the urban context. Through initiatives that variably promote and pursue sustainable development in relation to urban infrastructure, services, and the community at all levels like district, town, or metropolitan.

1-1- Definition of sustainable urbanism

The main focus of sustainable urbanism lies in the design of urban environments and aims to implement sustainable solutions through these designs. In order to become sustainable cities, need to adopt a new approach to planning the

city. The ‘city that plans’ uses integrated and multi-sectored planning approaches, considers local circumstances and involves diverse populations including women, plans are prepared at different geographical scales . The New Urban Agenda aims to harness the potential of cities and human settlements to help eradicate poverty in all its forms and dimensions, reduce inequalities, promote inclusive growth, and achieve sustainable development⁽²⁾.

The urbanism sustainable is concerned with the study of:

- Urban phenomena in terms of urbanization and city organization.
- The relationship between urban planning, sustainability and sustainable development.
- Focus on promoting their long-term resilience and viability through reducing material use, lowering energy consumption, mitigating pollution, and minimizing waste.
- Improving social equity and human well-being.
- Eliminate the environmental impacts of urban development by providing all resources locally more efficient and evaluating the full life cycle of the ecosystem and public services and goods from production to consumption.
- Designing communities that are walkable and transit-served so that people can meet their daily needs by walking.
- Bringing everything closer together (compact city/closing the loop)⁽³⁾.
- Sustainable transportation.

1-2- The impact of climate change on sustainable urbanism

Climate change effects deepen the vulnerabilities of cities in poor nations and threaten the resilience and adaptation capacities of cities in richer countries. Stronger storms and saltwater intrusion in water systems have weakened adaptive capacities in coastal cities of both developed and developing countries.

Most disasters tend to occur in developing countries and the cost is much higher in these countries⁽⁴⁾. Coastal developments in urban centers are likely to sharpen disaster risks from sea-level rise and increased intensity and frequency of storms and floods⁽⁵⁾. The concentration of people and economic activity in areas at risk from extreme weather events or earthquakes can interrupt global supply chains, reduce economic output, reverse development gains, and affect the livelihoods of the poor who often live in those areas⁽⁶⁾.

1-3- Challenges & opportunities for Sustainable Urbanism

Sustainable urbanism is associated with analyses focusing on the main social, economic and environmental challenges. However, the securing the necessary resources for investment in disaster-proof public infrastructure, renewable sources of energy and providing incentives to the private sector to create decent employment for large urban populations that are underemployed and have limited access to good housing conditions, clean water, drainage

and schools. Some of the most significant challenges and opportunities associated with sustainable urbanism are illustrated more extensively below as shown below in table 1.⁽⁷⁾ That already have access to basic public services face the challenge of becoming more efficient in the use of energy and water, reducing the generation of waste, and improving their recycling systems. The growth of cities has often gone hand in hand with the increased use of natural resources and ecological systems⁽⁸⁾.

1- Eco-cities as a concept

Eco-city is a term to describe many synonymous ideas and concepts such as “low carbon cities”, “environmental society”, “ecological urbanism” and “green city”. Planning for Eco cities is an integration of planning approaches that arise as a response to the effects resulting from the industrial revolution and economic development over the past 150 years.

Nonetheless, there is some consensus on the basic features of the eco-city among common definitions as “an urban environmental system in which input (of resources) and output (of waste) are minimized”⁽⁹⁾.

2-1-why there is a need for eco-cities

They aim to deliver more efficient land use, improve green energy systems, and build a resilient and adaptable urban community.⁽¹⁰⁾

In this respect, a recent wave of research has started to focus on improving the performance

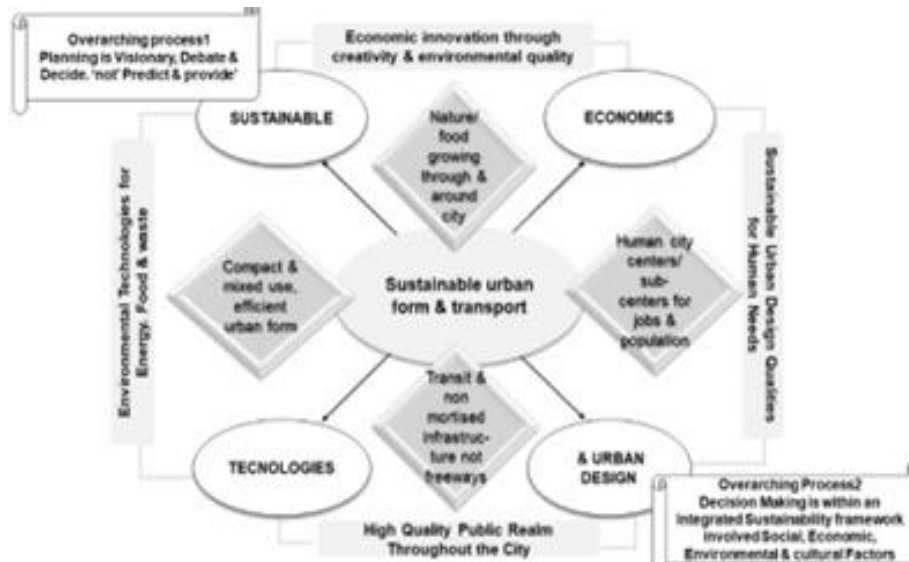
of eco-cities by partly or completely integrating their green design principles and environmental technology solutions with compact design strategies ⁽¹¹⁾.

2-2- Developing the concept of Eco-cities

The first category, the type of development, is including (a) a city built from scratch; (b) the expansion of an existing urban area; and (c) retrofitting existing urban structures and environments through sustainability-focused innovations and adaptations. Also, an eco-city is based on three analytical categories: (1)

development on a substantial scale, (2) occurring across multiple domains, and (3) supported by policy processes⁽¹²⁾ But, Kenworthy⁽¹³⁾ argues that the eco-city should incorporate 10 key principles, with sustainable urban form and transport at the core of the model as shown in Fig1.

Fig. 1 A conceptual model for the eco-city based on 10 key principles in urban planning, urban transport, urban design, and planning process considerations.



Source: Kenworthy⁽¹⁴⁾

2-2-1- Models and practices

There are many models of the eco-city, which can be categorized into three types: (1) emphasizes passive solar design, (2) combines passive solar design and greening, and (3) focuses on green energy technologies and/or smart energy and environmental technologies (Table 2)⁽¹⁵⁾. Type 3 relates to the concept of the smart eco-city, which captures the recent trend of future-oriented urban development schemes

that display both green and smart ambitions. The authors show that there are three periods of eco-city practice development in China: eco-cities (the 1990s), low-carbon cities (2000s), and smart-eco cities (2010s).

During the 2000s, the focus shifted to cutting greenhouse gases (GHG) amid the severe domestic environmental situation and international societal pressure. During the

2010s, great importance was attached to the city attempt to integrate eco-cities and smart cities. with green and ecological concepts in an

Table1: Challenges to and opportunities for sustainable urbanization

Main urban trends	Developing countries		Developed countries	
	Challenges	Opportunities	Challenges	Opportunities
Social				
By 2025, urban population will live mainly in small cities (42 per cent) and medium-sized cities (24 per cent)	Improve access to housing, water, sanitation; improve public infrastructure; foster institutional capacity	Investment in public infrastructure (including transportation); construction of compact buildings in middle-income countries; strengthen links between cities and rural areas	Social cohesion	Investment in compact urban development and decentralization
Number of urban people living in slums continues to grow	Reduce number of urban poor and disease risk; improve social cohesion; reduce youth unemployment	Investment in universal access to affordable water and sanitation; establishing public transportation, and creation of jobs to reduce growth of slums; employment of the “youth” dividend in low-income countries	Reduce urban unemployment due to economic crises (of youth in particular); provide adequate housing in poor neighborhoods	Strengthening and widening social safety nets; upgrading investment in social protection for an effective response to crises and their aftermath
Inefficient use of public services (water, electricity)	Improve waste and recycling management; support consumption of local produce; change overconsumption patterns of high-income households	Subsidies to households and small firms to reduce non-saving water systems and waste; incentives to local communities to improve recycling systems	Change overproduction and overconsumption styles; improve waste and recycling management	Investment in retrofitting of buildings; in water- and energy- saving devices; upgrading of public infrastructure
Ageing	Create productive employment for older persons	Investment in universal pensions; extension of working age; support for family networks	Fiscal pressure to reduce health costs; improve productivity	Investment in retraining older persons, and extending the working age
Economic				
Inequality and financial fragility	Create policy space for inclusive development; reduce underemployment; promote economic diversification	Investment in green industry, adaptation to climate change, structural economic change (industrial and service leapfrogging for least developed countries); strengthening regional cooperation	Reduce unemployment; boost economic growth; strengthen international cooperation	Investment on green infrastructure; policy coherence and coordination
Food insecurity	Improve access to food; increase productivity	Investment in urban agriculture, local crops, storage facilities; R&D	Reduce food waste	Investment in storage infrastructure; reducing food subsidies; policy coordination
Environmental				
Energy access	Provide access to clean energy and reduce use of “dirty” energy in poor households (e.g., least developed countries); discourage high-energy consumption in high-income households	Investment in capacity development, energy-saving devices, production and use of renewable sources of energy; subsidies and incentives for efficient energy use and water use for middle- and high-income households	Reduce overproduction and overconsumption to sustainable levels	Investment and incentives to produce and use renewable energy sources; decentralization of energy production
Climate change	Reduce impact on livelihoods; reduce carbon emissions; generate financial resources for adaptation	Investment in health and education infrastructures and facilities; adaptation and mitigation technology, early warning systems, green public transportation; strengthen regional cooperation for green technology transfer	Upgrade disaster risk prevention systems; reduce carbon emissions to sustainable levels	Investment in mitigation, industrial green transformation; retrofitting of buildings; policy coordination

Table 2: Three types of eco-city models

Type 1	Type 2	Type 3
<ul style="list-style-type: none"> • Eco-village • Solar city • Solar village • Cohousing • Sustainable housing 	<ul style="list-style-type: none"> • Eco-city • Eco-district • Environmental city • Green city • Garden city • Sustainable neighborhood • Sustainable community • Sustainable urban living • Living machines • Techno-city • New town 	<ul style="list-style-type: none"> • Symbiotic city • Carbon neutral city • Zero energy city • Zero carbon city • Net zero carbon community • Low carbon city • Energy efficient city • Ubiquitous eco-city • Smart eco-city • Data-driven smart eco-city

2-3- Challenges & opportunities for Eco -Cities: (+ Concepts of needs and limitations)

The challenge and opportunities for eco-city continue to strive toward reaching the status of urban sustainability by reducing material use, lowering energy consumption, mitigating pollution, and minimizing waste, as well as improving social equity, well-being, and quality of life and manage eco-cities in new and innovative ways. These are increasingly based on more advanced forms of ICT, especially the Internet of things (IoT) and big data technologies.

The United Nations’ 2030 Agenda regards advanced ICT as a means to promote socio-economic development, restore and protect the environment, increase resource efficiency, upgrade legacy infrastructure, and retrofit industries based on sustainable design principles. This relates to the multifaceted potential of smart cities .The main objective of the smart city is achieving heightened economic development, quality of life, and different sustainability targets through the use of data and technology. This means finding more effective ways of incorporating sustainability

into the physical, spatial, environmental, economic, and social forms of eco-cities⁽¹⁶⁾.

Conclusion: A future vision of sustainable cities in today's world

A future vision of sustainable cities in today's world the urbanization involves a multitude of environmental, economic, social, and spatial conditions, which pose unprecedented challenges to politicians, policymakers, and planners. These changes provide great opportunities for advancing sustainability in terms of applying innovative technologies to use resources more efficiently and control them more safely, to promote more sustainable land use, and to preserve the biodiversity of natural ecosystems and reduce pressure on their services, with the aim to improve economic and societal outcomes. In a nutshell, cities across the globe hold the potential to maximize the benefits of urbanization and offset its negative consequences by relying on emerging and future information and communication technology (ICT). In fact, urbanization has

become a popular discourse in urban policy and academic circles across the world due to the rising popularity of smart urbanism and its potential role in advancing urban sustainability. Careful planning would help achieve a more efficient, integrated use of resources. Examples of these often referred to as wicked problems⁽¹⁷⁾⁽¹⁸⁾, are climate change, mass migration, and disruptive technological developments. These are impossible to predict and are therefore inherently uncertain. A second element consists of enforced uncertainties. Several sustainability transitions, such as the transition towards a green economy⁽¹⁹⁾ or a low-carbon energy system⁽²⁰⁾⁽²¹⁾ are deliberately enforced by international agreements and national policies. This type of uncertainty will impact the urban system. In order to accommodate these transitions, the city itself needs to transform. In order to tackle the uncertainties two strategies will be

distinguished here: the first is to fix the future and the second is to indulge the future.

First Strategy: Fixing the future

Fixing the future strategy aims to increase the environmental resilience of the urban environment where the future is repaired, even before it is lost. Through the application of urban design principles. In and around the city ecological water and green systems are implemented and renewable energy sources are cultivated or generated and sustainable modes of transportation are implemented. New uncertain developments, such as the impacts of climate change, are hard to incorporate.

Second strategy: Indulging the future

The strategy of indulging the future aims to increase the spatial resilience in the city. In accommodating change urban form should be flexible and adaptable⁽²²⁾

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