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REVIEW ARTICLE

Green Urbanism

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I N F O R M A T I O N

A B S T R A C T

With the rapid growth of urbanization world over, multi-dimensional problems are a challenge. These problems are in the form of extensive concreting with less open spaces leading to heat island and albedo effects. Unplanned development of urban areas; such as; lack of optimization between vertical to horizontal expansion, lack of optimization between concerting to the non-concreting urban surface, inadequate carrying capacity of the road network, water resources, atmospheric stabilities and so forth. All such problems combined lead to environmental imbalance and consequently environmental pollution to a greater extent. The predominant solution to such a wide problem could be effectively addressed through Green urbanism. It can be reasonably be defined as the practice of creating communities beneficial to human and the environment. Green urbanism is an attempt to shape more sustainable places, communities and lifestyles, and consume less of the world's resources. It is interdisciplinary, combining the collaboration of landscape architects, engineers, urban planners, ecologists, transport planners, physicists, psychologists, sociologists, economists and other specialists in addition to architects and urban designers. An effort has been made by the authors of the present paper to highlight the concept of green urbanism coupled with its relevant indicators and consequential benefits to address the problems referred to above and also to create an educational tool for awareness among stakeholders.

1. Introduction

The emergence of the concept of green urbanism had a gradual start in the late 1800s when some large cities of the United States (US) started using advanced drinking water, sewage and sanitary systems. Consecutively, public parks and open spaces were implemented in New York City.

At the end of the World War II, the US government offered its citizens affordable housing in easy loan to boost up city population and also introduced a new federal Interstate System, combined with a rise of automobile ownership, gave away to a novel way of life called 'Suburbia'. Meanwhile, in the 1950s the inhabitants of other industrial cities, including Chicago, Detroit, St. Louis, Cleveland and Philadelphia had experienced greener suburban pastures. But all those green

trees died because of old age or pollution and were not replaced. After a decade of the 'Urban Renaissance', the term used by Richard Rogers, came into light in 1990. Europe was never far behind to endorse urban sustainability. 'The Green Paper on the Urban Development' published in 1990 considered as a 'milestone' document in promoting sustainable city projects as a solution to the global environmental role (Odum, 1971; Rydin, 2010; Beatley, 2012).

Lehmann (2010) mentioned that since then cities have engaged themselves in a global - scale competition with each other in three distinct areas. These are, firstly, to be regarded as an attractive, creative place and a cultural hub to attract highly skilled workers and Melbourne, Australia was strong

competition with arts, museum and university; secondly, to get recognition as a place for a secure investment, mention-worthy, Dubai, Shanghai, and Singapore have topped in attracting and facilitating global investment capital; and thirdly, to become a leader of green vision for the future by technological advancement and offering environmentally sound lifestyles and also providing green jobs and Hannover, and Copenhagen did well in this field. After the earth Summit, 1992, different terms, including, sustaining cities (Leitmann, 1999), sustainable cities (Beatley, 2012), sustainable urbanism (Farr, 2008), green city (Karlenzig et al., 2007), eco-towns, eco-districts and eco-development, eco-cities (Lehmann, 2010), have tried to reduce environmental impacts on the cities and to achieve sustainable development. Both the green and sustainable cities present fundamental opportunities to apply new technologies, for example, public transport, district heating, green building and green design and also bring major lifestyle changes such as, walking, bicycling, and reduce energy consumption.

The major agenda of all kinds of the above-mentioned cities are tackling global climate change, biodiversity loss, and also lift themselves as 'hosts' of all environmental challenges. It has been argued that the focus of these theories is mainly on adjusting the relationship between the city and nature and also creating new cities other than renovating existing cities. To address the gap, Beatley (2012) and Lehmann (2010) used the 'green urbanism 'theory that aims to transform existing cities from fragmentation to compaction. Three pillars of green urbanism are reflected in Fig. 1 below with different indicators to explain the concepts involved and indicators infused.

Fig. 1. The three pillars of Green Urbanism and the interaction between these pillars (Lehmann, 2010).

2. Important factors of green urbanism

According to Beatley (2012), green urbanism is an attempt to shape more sustainable places, communities and lifestyles, and consume less of the world's resources. The important factors governing green urbanism are as follows.

2.1. Vision

Beatley (2000) remarked that the vision of green urbanism includes programs, policies and creative design ideas for urban renewal and environmental sustainability. Lehmann (2010) added the phrase also provides a proactive vision of what might be our zero-carbon, fossil fuel-free future: overlapping mixed-use activities, living and working building typologies explored on the urban scale, infrastructures systems for renewable energies, public transport and individual energy-efficient building designs. According to Beatley (2000), cities that exemplify green urbanism are:

o Cities that strive to live within their ecological limits, fundamentally reduce their ecological footprints, and acknowledge their connections with and impacts on other cities and communities and the larger planet.

o Cities that are green and that are designed for and function in ways analogous to nature.

o Cities that strive to achieve a circular rather than a linear metabolism, which nurtures and develops positive symbiotic relationships with and between its hinterland (whether that be regional, national, or international).

o Cities that strive toward local and regional self-sufficiency and take full advantage of and nurture local /regional food production, economy, power production, and many other activities that sustain and support their populations.

o Cities that facilitate and encourage more sustainable, healthful lifestyles.

o Cities that emphasize the high quality of life and the creation of highly livable neighbourhoods and communities.
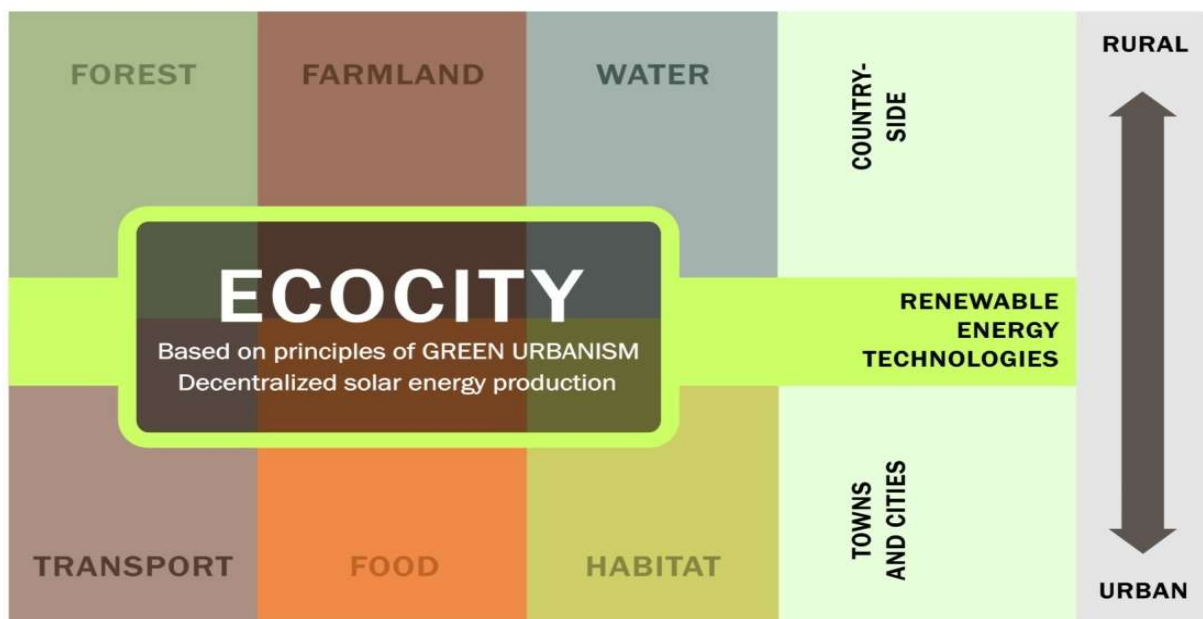

Fig. 2. Green urbanism - Holistic principles to transform cities for sustainability (Lehmann, 2010)

2.2. Principles

It has been noted that urbanization is widely understood to be a key driver of carbon emissions, resource depletion and environmental degradation. The principles of green urbanism are based on triple-zero frameworks. These are zero fossil - fuel energy use, zero waste and zero emissions especially aimed for low - to - no - carbon emissions. Lehmann (2010) tries to put up a strategic case study of green urbanism with the seaport city of Newcastle, New South Wales, Australia. According to him, there are 15 such principles of green urbanism those are practical and holistic and integrated

framework, including all the aspects needed to achieve sustainable development and encouraging best practice models, as follows.

2.2.1. Energy and materials
Renewable energy for zero carbon-dioxide emissions
Transform city districts into local power stations of renewable energy sources including solar photovoltaic system, solar thermal, wind on-and-offshore, biomass, geothermal power, mini-hydro energy and other new technologies. Some most promising technologies are in a

building-integrated solar photovoltaic system, urban wind turbines, micro combined heat and power (CHP) plants and solar cooling.

Local and sustainable materials with less embodied energy
City construction by using regional, local materials with less embodied energy and applying prefabricated modular systems.

Zero waste city
Waste prevention is better than the treatment or cleaning-up after waste is formed. So, the cities should adopt zero-waste urban planning in line with the manufacturing of metals, glass, plastics, paper into new products and a better understanding of nutrient flows is needed to control global nitrogen cycle.

Local food and short supply chains
High food security and urban agriculture by introducing 'eat local' and 'slow food' initiatives.

2.2.2. Water and biodiversity
Water
Cities can be used as a water catchment area by educating the inhabitants in water efficiency, promoting rainwater collection and using wastewater recycling and stormwater harvesting techniques. In terms of food yielding level, less water needed and drought-resistant crops can be developed.

Landscape, gardens and biodiversity
Introduce inner-city gardens, urban farming /agriculture and green roofs to maximize the resilience of the eco-system through urban landscape thus to mitigate UHI effect. Plants can be used for air - purification and narrowing of roads for urban cooling.

Moreover, preserving green space, gardens and farmland, maintaining a green belt around the city is a necessity to absorb carbon dioxide. Sustainable transport and good public space, compact and polycentric cities. An integration of non-motorized transport, such as, cycling or walking and bicycle or pedestrian-friendly environment with safe bicycle ways, eco-mobility concepts and smart infrastructure that is electric vehicles, the integrated transport system of bus transit, railway and bike stations, improved public space networks and connectivity and a focus on green transport-oriented developments (TOD).

2.2.3. Urban planning and transport
Green buildings and districts, using passive design principles
The city, here, applies deep green building design strategies and offers solar access for all new buildings.

Density and retrofitting of existing districts
The city is with retrofitted districts, urban infill, and densification/intensification strategies for existing neighborhoods.

Climate and context
Based on climatic condition before the selected city, every sustainable design project needs to maintain a complexity within biodiversity, ecosystem or neighborhood layout. Enhance the opportunities offered by topographies and natural settings and use of the buildings' envelope to filter temperature, humidity, light, wind and noise.

The realistic principles, more often used as holistic principles, are reflected in Fig. 2 below, particularly transforming cities into sustainability. The relevant concepts for achieving sustainable city is shown in Fig. 3 whereas relevant indicators governing green urbanism are reflected in Fig. 4.
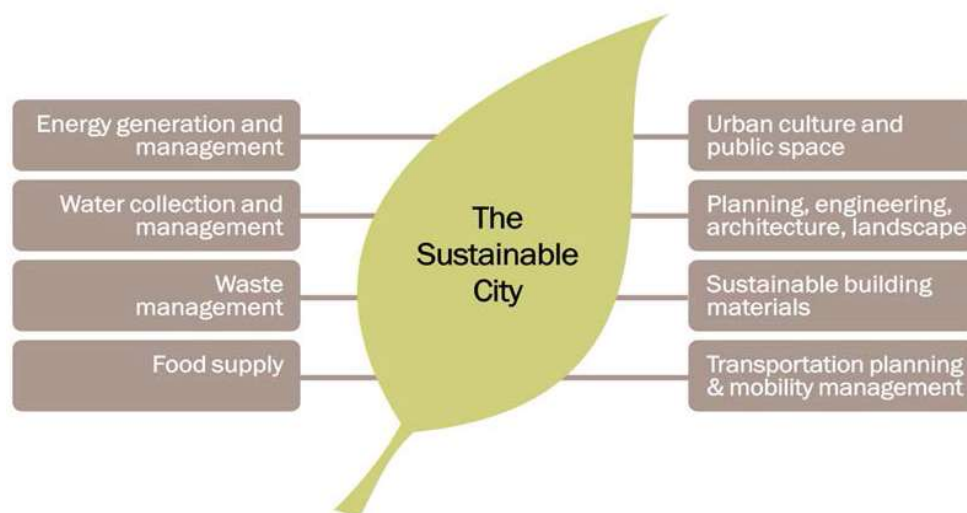

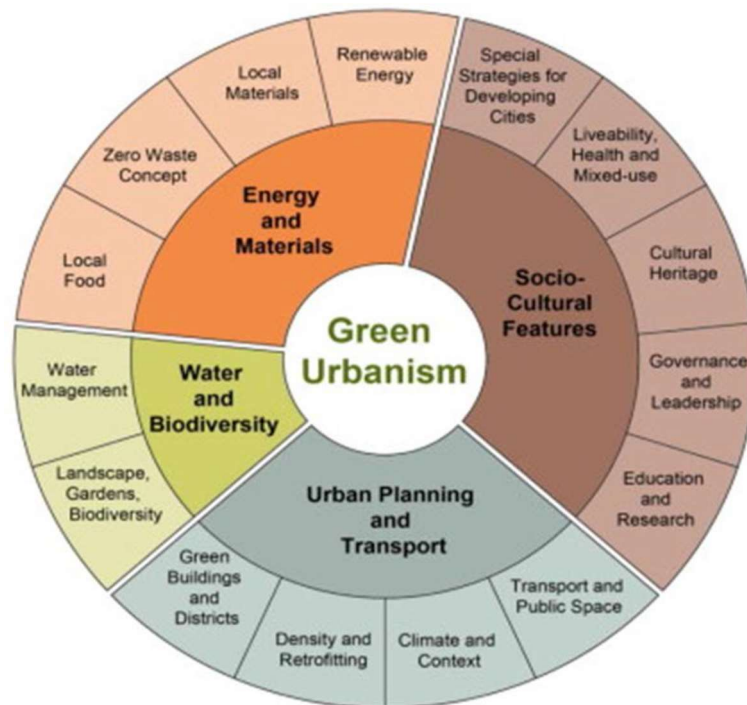Fig. 3. The concept of sustainable city (Lehmann, 2010)

Fig. 4. The 15 principles of green urbanism and their interconnections (Lehmann, 2014)

2.2.4. Socio-cultural features

Education, research and knowledge
The city with education includes technical training and up-skilling, research, exchange of experiences and knowledge dissemination for all in sustainable urban development.

Urban governance, leadership and best practices
The city applies best practice for good urban governance through combined management and governance approaches and sustainable procurement methods, such as environmental budgeting.

Cultural heritage, identity and sense of place
A sustainable city with high air quality, no pollution for good health, fosters resilient communities having public space networks and modern community facilities.

Livability, healthy communities and mixed-use programs
The prime concern of the city is for affordable housing, mixed-use programs and a healthy community.

Strategies for cities in developing countries
Particular sustainability strategies are needed for cities in developing countries, such as train local people to empower communities, creating new jobs and diversifying structures to harmonize the impacts of rapid urbanization and globalization. It may, however, be realized that smart growth coupled with green infrastructure can go together and support each other. A conceptual framework for compact and green cities is reflected in Fig. 5.

3. Practical Approaches
Many cities now have Sustainable Action Plans (The city of Vancouver, 2018) which is a roadmap towards sustainability.

Green Urbanism has grown from textbook methodologies to living action plans that survive beyond the election cycles of city mayors and counsellors. Green Urbanism poses the demand for an applicable method in planning and management of a city. Kuitert (2013a) proposed analyzing the city as a landscape system to reach a more comprehensive approach towards this end.

The urban landscape connects the Cultural components, like identity and history with the natural physics of a city, like its geography, water and natural ecology. As such it poses a vision that can be applied to any city, rich or poor (Kuitert, 2013a). Discerning the potential quality of wild nature in the city is a first step to see what nature can give if we only have an open eye for it. It is discovered through the potential vegetation map for the city (Kuitert, 2013b). A green urbanism master plan of Shanghai is shown in Fig. 6.

Moreover, a hill located at Jhalana area, in Jaipur, Rajasthan, India which was earlier without vegetative cover due to mining activities was now fully green by applying untreated sewage. These are the small steps taken to conceptualize the importance of green urbanism.

Conclusions
The present, the major challenges faced by humanity are due to growing population and environmental degradation which results in global climate change, excessive fossil fuel dependency and growing demand for energy. The majority of the world cities are confronted with similar and comparable challenges, including for instance increases in resource consumption, mobility demand, pollution, urban sprawl, social inequities, erosion of fertile topsoil and depletion of ecosystems.
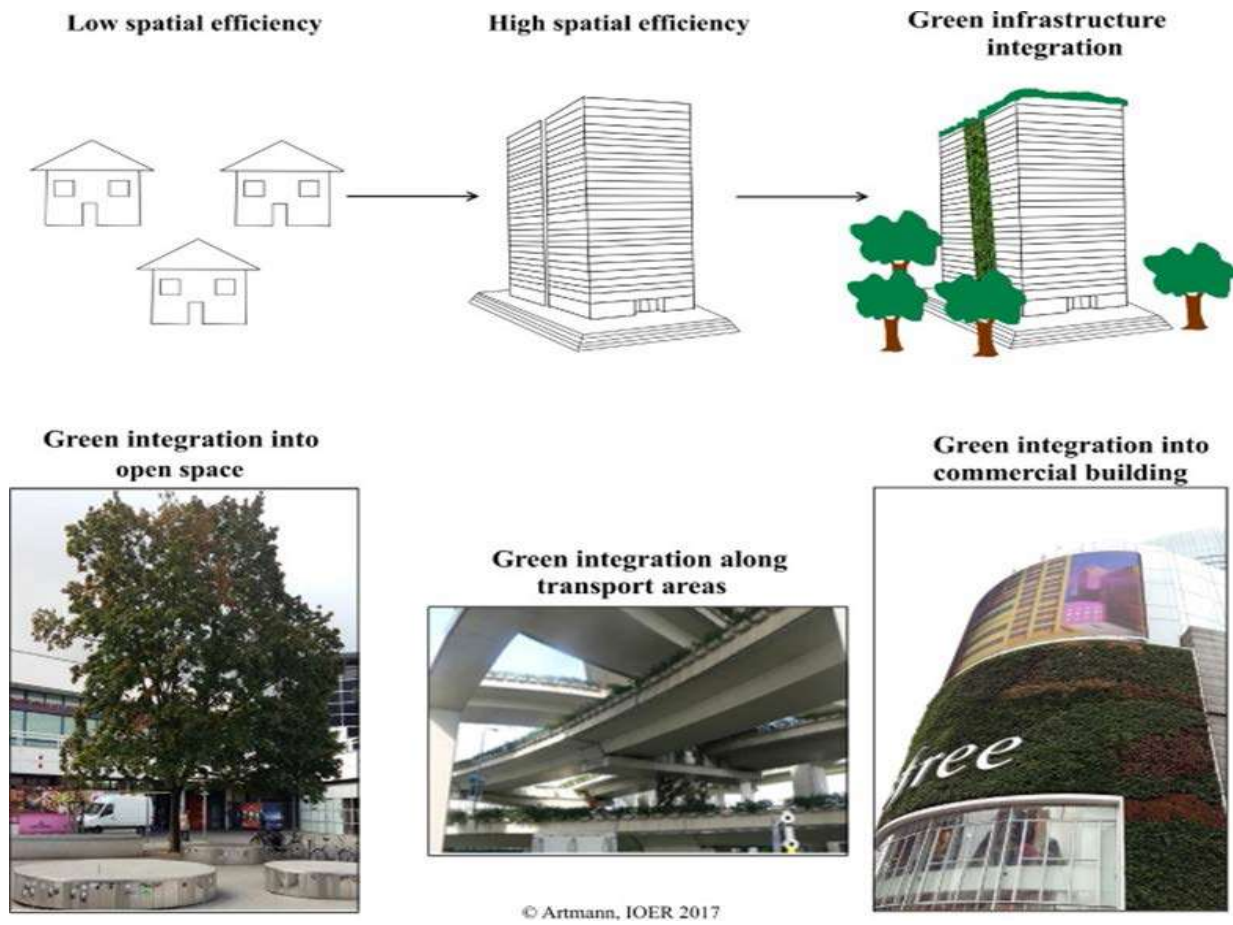
Fig. 5. Smart growth and green infrastructure can mutually support each other - a conceptual framework for compact and green cities (Artmanna et al., 2019)

Fig. 6. New Green Urbanism city master plan, Shanghai, PRC (SOM, 2020)

Since its early days, the discourse around *"smart cities"* has Included environmental sustainability as one of its core principles. In this context, urban design is the fundamental principle of how to shape our cities. Because almost half of the energy consumed is used in cities and urban built-up areas, it is necessary to avoid mistakes in urban design at early stages to own more sustainable cities. Green urbanism reflects upon practical strategies focusing on increasing sustainability beyond and within the scope of individual buildings.

The concepts of green urbanism should popularize not only at an individual level but also among all stakeholders. Extensive research needs to be taken up and encouraged about green urbanism in respect of its planning and simulation models, benefits on energy and water savings, wastewater utilization in raising green infrastructure, scientific layouts, waste reduction and transformation into usable products, environmental quality improvement and so on so forth. A comprehensive data should be developed to keep all such researches at one place to be used by other researchers to extend further.

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