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GREEN CITY – FUTURE SUSTAINABLE DEVELOPMENT AND SMART GROWTH

ABSTRACT

The concept of the green city originally came from Europe and the North American countries, where it is very different from the concept in Asian countries because of climate, the people's backgrounds, and the culture, goals, and history of city development. A green city is a city that demonstrates high environmental performance compared to established criteria in terms of 1) the quality of environmental assets (air, water, land / soil and biodiversity), 2) the efficient use of resources (water, energy, land and materials) and 3) mitigating risks and adapting to the risks of climate change, while maximizing economic and social co-benefits, taking into account the context of the city (population, socio-economic structure and geographic and climatic characteristics). City greening is one of the ways to pursue a green city. It is aimed at replacing the loss of green spaces that have disappeared in ongoing urban land conversion for housing and transportation. As stated in the definition of the Green City approach, measures to improve the environmental performance of a city should also seek to maximize economic and social benefits. These links between economic, social and environmental goals will provide additional motivation for city leaders to take green city action.

KEYWORDS: green city, city development, economic and social benefits

INTRODUCTION

The green concept is an environmentally friendly concept for city planning and development. The concept covers different layers of planning and design, and encompasses several stages. The underlying action for successful sustainable city development is to ensure that ecocities are managed carefully on every level. No less important, all city design components need to work interactively and inseparably [*Lehmann,* 2011]. With the growing recognition of the environmental crisis in the 1970s and climate change in the 1990s, environment awareness, the concepts of sustainable cities, healthy cities, compact cities, and ecological cities evolved gradually and then gave birth to the concept of the green city, revealing a new beginning in urban design theory. Green city planning and design is one solution to the global warming phenomenon [*Wikantiyoso, Tutuko,* 2013]. Cities are responsible for many current global environmental challenges, ranging from air pollution to sanitation issues. The question is – can they also be key sites and actors for global environmental solutions? Taking a closer look at the actual developments, policies, and negotiations in urban spaces, it becomes obvious that labels such as "green city," "eco-city," "sustainable city," or "smart city" are far from clear-cut descriptions of objective qualities of cities. While all concepts broadly characterize a city designed with considerations for social, economic, and environmental impact on existing generations as well as future ones, these labels point to a wide range of environmental issues, policy solutions, and applied strategies that are often not consensual. They may be the result of intense struggles and political debates in which issues of social and environmental equality and justice play a major role [*Müller, Mattissek,* 2018]. For example, green city activities that can generate significant

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co-benefits for work can be easily justified and prioritized over other green city activities with *less* positive economic impact. In addition, providing access to clean and efficient services such as water, energy and solid waste collection for all urban dwellers (including in less affluent areas) will not only improve the environmental performance of cities, but also ensure the achievement of social goals. In contrast, urban populations with high environmental awareness will be more likely to use sustainable infrastructure systems (public transport, segregated waste collection) and will encourage the elected government to adopt a green agenda. Our opinion on the challenges in achieving the goal of the green city concept, a city is considered by planners and architects as a living organism, which is built from many cell units [*Shen* et al., 2018]. A green city is defined as an environmentally friendly city that is represented by environmental performance indicators [*Meadows,* 1999]. Other indicators include diversified housing, a public transportation system, human-oriented traffic, an ecological footprint, etc. [*Ewing* et al., 2010]. The United Nations Environment Program defines the green city from the perspective of urban development and environmental quality[1]. The definition of green cities through environmental quality performance does not mean ignoring social justice. In fact, a greener living environment can promote more equitable treatment of a city's residents. There is no universal solution that could be applied to every city in any country. Adaptable, responsive, and innovative solutions that differ from one place to another enable green cities to emerge in various guises and recognize the variation and dynamism of cities[2]. Finally a Green City is a city which shows high environmental performance relative to established benchmarks in terms of i) quality of environmental assets (air, water, land/soil and biodiversity), ii) efficient use of resources (water, energy, land and materials) and iii) mitigating and adapting to risks deriving from climate change, while maximizing the economic and social co-benefits and considering its context (population size, socio-economic structure and geographical and climate characteristics)[3]. Nowadays many developed countries have adopted the Green Cities concept as strategic tool to face environmental challenges in general and climate change impacts in particular. With climate change concerns gaining mainstream attention, pressure is mounting for greenhouse gas (GHG) reduction to be taken into account during the course of urban development. From an environmental perspective, we should protect natural resources and include sustainability in development strategies [*Ahmed,* 2013].

MATERIALS AND METHODS

The methods used in the publication include analysis of publications and documents, direct and indirect observations, expert evaluation, methods for time-dependent analysis – retrospection and forecasting, analysis, synthesis, comparison and summary.

RESULTS AND DISCUSSION

The green city is a city prone to innovation, which applies a strategic approach and achieves the same and higher economic value with fewer and renewable raw materials and less waste. The population of the green city enjoys a favorable living and working environment and acquires a cultural identity within the city in accordance with the history and natural resources of the place. The green city is an inseparable unity of people, infrastructure and procedures that promote its sustainable development. Green cities are places where people want to live and work now and in the future. They meet the needs of residents, integrate well with the environment and contribute to a high quality of life through security, inclusion, good planning, equality and good services for all.

Sustainable urban development should take a broad view of urban issues and attempt to solve urban problems by integrating environmental, social, and economic components. In other words,

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[1] *United Nations Environment Programme* Cities, investing in energy and resource efficiency: towards a green economy. 2011, United Nations Publishing

[2] *Asian Development Bank* Green city development tool kit, Mandaluyong City. Asian Development Bank, 2015, Metro Manila

[3] *Green cities methodology – final report*, European Bank for Reconstruction and Development, 2016

merely solving problems of air or water pollution will not bring us much further. What is needed is an inclusive approach that determines how a variety of pressing urban problems are linked, while taking into account social problems such as poverty, homelessness, the spreading of tuberculosis in major cities, HIV, or lack of access to potable water in cities in developing countries. For example, research in the U.S. indicates that there is a pattern of disproportionate exposure to environmental hazards and degradation among marginalized groups, including racial and ethnic minorities and poor, less educated, and politically powerless people [*Devuyst* et al., 2001]. This phenomenon is referred to as "environmental racism" and has led to a movement for environmental justice[1].

Cities are spatial centers of human activity and interaction. They are the drivers of the European economy, providing jobs and services and serving as a catalyst for creativity and innovation across the EU. More than 75% of the EU's population lives in urban areas, accounting for more than two-thirds of EU GDP. However, these are also places where persistent problems such as unemployment, segregation and poverty are concentrated and there is enormous pressure on the environment. That is why urban policies are more important for the EU as a whole.

It is becoming increasingly clear that the various challenges facing urban areas – economic, environmental, climate, social and demographic – are intertwined and that successful urban development can only be achieved through an integrated approach. Therefore, measures for physical urban renewal should be combined with measures to improve education, economic development, social inclusion and environmental protection.

The concept of the green city originally came from European and the North American countries, where it is very different from the concept in Asian countries because of climate, the people's backgrounds, and the culture, goals, and history of city development. A green city is a city that demonstrates high environmental performance compared to established criteria in terms of 1) the quality of environmental assets (air, water, land/soil and biodiversity), 2) the efficient use of resources (water, energy, land and materials) and 3) mitigating risks and adapting to the risks of climate change, while maximizing economic and social co-benefits, taking into account the context of the city (population, socio-economic structure and geographic and climatic characteristics).

European cities are facing many of the same serious problems and trends that are working against sustainability in American cities: a dramatic rise in auto ownership and use, a continuing pattern of deconcentration of people and commerce, and a lack of affordable housing. European cities exert a tremendous ecological footprint on the world, as do American cities (although European cities produce about half the per capita carbon emissions of American cities). Yet, despite these trends, European cities still represent a much more compelling model for the times we live in: at once more energy- and resource-efficient, more supportive of innovative green projects, more demanding of the environmental performance of buildings and cityscapes, and generally more reflective of a priority given to sustainability. There are certainly many differences between the American and European contexts – social, political, economic – that help explain why green city ideas have had greater application and currency in Europe. These include a more limited land and resource base, a long history of urban living, a stronger planning and regulatory system, a parliamentary political system that often gives greater representation to green concerns, and stronger cultural support for a variety of green city ideas (e.g., public transit, pedestrian environments, energy conservation). Nevertheless, these compelling European examples will and should find ever-greater currency on the American scene, as the environmental challenges we face become ever more serious (e.g., climate change, declining oil supplies, severe water shortages), and the inherent merits of these forms of green urban living become ever more obvious [*Beatley,* 2012].

The deterioration of the environment caused by several urban activities creates the need to rethink the habits and ways in which we deal with the use of space. Cities around the world have grown wildly, causing floods, pollution, deforestation, social inequalities, housing in high risk areas,

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[1] *WRI, World Resources Institute*. 1999. 1998-1999 World Resources. Environmental Change and Human Health. Washington, DC: World Resources Institute

unemployment and many other problems. Urban pollution poses a serious threat to public health. Many of them do not have adequate sewerage systems and treatment plants, which leads to huge amounts of human waste and industrial wastewater, which is discharged into the environment on a daily basis. Green urban projects seek to minimize or solve all these problems. Areas such as smart and sustainable development, land use, transport systems, energy, water, waste management, education and public policies need to be integrated to offer better living conditions for urban dwellers.

City greening is one of the ways to pursue a green city. It is aimed at replacing the loss of green spaces that have disappeared in ongoing urban land conversion for housing and transportation. As stated in the definition of the Green City approach, measures to improve the environmental performance of a city should also seek to maximize economic and social benefits. These links between economic, social and environmental goals will provide additional motivation for city leaders to take green city action. For example, green city activities that can generate significant co-benefits for work can be easily justified and prioritized over other green city activities with less positive economic impact. In addition, providing access to clean and efficient services such as water, energy and solid waste collection for all urban dwellers (including in less affluent areas) will not only improve the environmental performance of cities, but also ensure the achievement of social goals. In contrast, urban populations with high environmental awareness will be more likely to use sustainable infrastructure systems (public transport, segregated waste collection) and will encourage the elected government to adopt a green agenda.

The green city is characterized by the fact that there is a direction of development. The principles in its planning correspond to the concept of a green economy. The green city definitely does not allow compromises with any of the three key blocks of sustainable development: economic, social, natural. If the economic product and the quality of the environment increase at the expense of the social exclusion of the poor in miserable suburbs and the settlement of the rich in "green" closed neighborhoods, we are no longer talking about a sustainable city. The same applies to the export of harmful environmental effects or waste to the hinterland, which creates a seeming sense of solved environmental problems.

Green Cities are concerned with how to design the whole city in a more sustainable, efficient, adaptive and resilient way. Green Cities recognise connections between different sectors and support development strategies that fulfil multiple functions and create multiple benefits for society and urban ecosystems. In the context of urban water resource management, a Blue-Green City calls for the holistic planning and management of water, wastewater and stormwater across the whole city to ensure that populations are resilient to climate change and extreme weather events while ensuring the health of aquatic ecosystems. In a Blue-Green City, Blue-Green Infrastructure (BGI) involves the use of natural or man made systems to enhance ecosystem services in the management of water resources and increase resilience to climate risks. BGI solutions can also be used to support the goals of multiple policy areas. For example, green spaces and restored lakes and wetlands can reduce flooding risks to neighbourhoods while simultaneously supporting urban agricultural production and wildlife, in addition to providing recreational and tourism benefits. In Blue-Green Cities, urban water managers also use a variety of innovative fiscal and non-fiscal tools to encourage the implementation of BGI on public and private property to sustainably manage water resources and increase resilience to climate risks [*Brears,* 2018].

Green cities as a way of functioning resemble natural cycles, i.e., they are semi-closed type systems. In terms of cybernetics, the green city is made up of integrated closed loop systems. Although this contradicts today's experience, in the green city as well as in nature there is no waste: synergy is achieved between the individual components of the city and the output of one industry becomes the entrance to another. Not only the production and the consumption in the green city is integrated with the needs of the system; the same applies to tuning the rhythm of city life, i.e., transport organization and working hours.

An important characteristic of a green city is the population density in it. Contrary to popular belief, according to the World Bank, high urban population density is a favorable, "green" factor. The high concentration of population and business units allows to achieve technological innovations and higher efficiency; economies of scale are realized by reducing the

marginal costs of utility delivery. This reduces energy consumption and optimizes the water cycle. Therefore, planning "compact cities" is recommended.

In contrast, a city from which many rich suburbs swarm is associated with higher transportation costs due to the need to use personal vehicles and the long distances traveled. Utility supplies are associated with higher marginal costs. Therefore, the overall ecological balance becomes negative and such a city loses its green properties.

More and more, Europe strives for the green transformation of cities and the achievement of "zero emissions" in meeting the goals of the EC Green Deal. There are many questions to solve that require collecting huge amounts of data, performing various analyses, modeling and playing out scenarios using Geographic Information Systems (GIS) – Where are the heat islands in the city and what effective measures can be taken to overcoming the negative consequences of them? What are the best places for alternative energy sources and green infrastructure? What is the residents' accessibility to road transport, bicycle transport and pedestrian transport and where to build additional infrastructure? The cell units that compose a green city are classified on the basis of the several elements of the green city, which can work independently and cooperate with each other to form the city's metabolism and shape a solid void green city form. These elements are intertwined with the Geographical Information Systems in order to achieve a sustainable environment for the development of a green city. These elements of the green city include:

1. Green resources (water, energy, and materials): Green Energy such as wind, solar, and tidal energy have become increasingly important in recent times. With global energy consumption rising at an alarming rate, it is essential to find alternative energy sources as fossil fuels put much pressure on the environment. Geospatial Data has helped energy scientists and researchers to identify areas where setting up of these renewable energy sources would prove beneficial. It has helped find locations that are ideal for the optimum utilization of resources and benefits to society. GIS has also helped create an identifiable map of green energy sources across the world, which can help decision-makers and companies in the energy business with the availability of abundant, analytical data.

2. A green social system: To develop a better green social system, GIS helps to provide detailed guidelines for the "integration" of geospatial information with any other relevant data for solving social problems. Using high resolution satellite data and ancillary GIS information in combination with subjective social da ta we can map and qualify urban green areas in a more citizen-centred approach [*Lang* et al., 2008].

3. Green open space: Urban planning has become essential today. With smart cities becoming increasingly popular, GIS data has equipped urban planners and managers with a powerful tool. The ability of a GIS system to store and manipulate large amounts of data for analysis and decision making has given governments and urban planners the resources to effectively plan and create a resource-optimized world. With GIS data that is dynamic and helps analyze many variables at the same time, infrastructure planners can understand land patterns in their area, maintain green cover by optimizing the land available, and also help create an infrastructure that is energy-efficient and green.

4. Green waste: GIS knowledge and technology are necessary to be more successful, fast and efficient as a whole society. Accordingly, the application of a collective GIS approach will contribute to the achievement of improvements in various areas from environmental protection and biodiversity, through the reduction of soil, water and air pollution, to the management of crises and epidemics. And at the heart of the GIS approach is the continuous cycle of measuring, recording, analyzing, modeling, creating scenarios, forecasting and planning.

5. Green transportation: As for mobility – green transportation, well-developed transport networks are needed to make the city walkable and bikeable. People should be able to move around very easily – not only in their neighborhood, but also over distances between 5 and 10 kilometers. A GIS-based spatial analysis provides a powerful means of determining the accessibility variables. GIS spatial analysis module is utilized to calculate the time it would take a public bus or a walker to get to the nearest amenities (green spaces or the central business district). The green city should also have other public spaces, such as squares, where people

can gather for commercial and cultural activities. Such a variety of spaces in the city helps to respond to people's social needs. The building stock should also combine old with new, offering housing options for people of all income groups and integrating jobs. All these places should be easily accessible by public transport to encourage sustainable behaviour in people.

6. Green building: Green infrastructure has been a popular framework for smart development and conservation planning. If it is proactively planned, developed, and maintained in a systematical way, it also should be a better model for land use and spatial development in a city. By integrating a GIS-based ecological connectivity assessment with the patch-corridor-matrix model, we can provide a green infrastructure planning approach to guide the sustainable land use decision [*Chang* et al., 2012].

7. Green government: The geographic approach uses GIS as a framework for understanding the world and applying geographic knowledge to solve problems and guide human behaviour. When working toward making green decisions for your government, GIS provides the information you need, such as land use and zoning, and tools for improved operations such as vehicle routing[1].

A sustainable city takes pride in its many beautiful parks and public gardens. This pride is best formed through a strong focus on local biodiversity, habitat and ecology, wildlife rehabilitation, forest conservation and the protecting of regional characteristics. Ready access to these public parks, gardens and public spaces, with opportunities for leisure and recreation, are essential components of a healthy city. As is arresting the loss of biodiversity by enhancing the natural environment and landscape and planning the city using ecological principles based on natural cycles (not on energy-intensive technology) as a guide, and increasing urban vegetation. A city that preserves and maximizes its open spaces, natural landscapes and recreational opportunities is a healthier and more resilient city. The sustainable city also needs to introduce inner-city gardens, urban farming/agriculture and green roofs in all its urban design projects (using the city for food supply). It needs to maximize the resilience of the eco-system through urban landscapes that mitigate the "urban heat island" (UHI) effect, using plants for air-purification and urban cooling. Further, the narrowing of roads, which calms traffic and lowers the UHI effect, allows for more (all-important) tree planting. Preserving green space, gardens and farmland, maintaining a green belt around the city, and planting trees everywhere (including golf courses), as trees absorb CO_2, is an important mission. As is conserving natural resources, respecting natural energy streams and restoring stream and riverbanks, maximizing species diversity. At home, we need to de-pave the driveway or tear up parking lots. In all urban planning, we need to maintain and protect the existing eco-system that stores carbon (e.g., through a grove or a park), and plan for the creation of new carbon storage sites by increasing the amount of tree planting in all projects. The increase in the percentage of green space as a share of total city land is to be performed in combination with densification activities [*Lehmann,* 2011].

The green city fits into nature – or even fits into itself, instead of modifying the natural environment. It develops in parallel with the pronounced relief, climatic and biotic features of the place. Although due to the concentration of scientific units in sustainable cities the technologies are at an excellent level and the corresponding technological and scientific transfer to wider areas of public interest is taking place, the green city is more natural than a technological creature. The green city is the result of human collective natural intelligence, enhanced by purposeful and competent planning with the application of the necessary technologically innovative solutions. Cities need to be adapted to the natural conditions of the place where they are located, with strategies for the use of urban vegetation and surrounding areas to ensure abundance of water, energy and quality of life. This reduces the damage caused by extreme weather events and chronic infrastructure deficiencies resulting from unplanned urbanization.

GIS technologies provide an approach and a platform for the scenario, which analyzes the individual aspects of the data and in combination, as well as modeling the scenarios for the development. They present the possibility for the subsequent definition of knowledge-based policies. An

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[1] *ESRI*, GIS for Green Government Providing Sustainable Solutions, 2009

integrated view of the economic, social and ecological aspects that geographic information systems demonstrate is key to achieving a more comprehensive and effective response.

The positive economic result in the green city is formed thanks to the sectors that take care of the integration between the urban elements. And while the combination of private economic interests and entrepreneurial initiative is fully utilized within these sectors, the green path of the city is directed and, if necessary, initiated and corrected by the public authority in the face of local government. GIS technologies are the main platform in many European cities for the purpose of green technology, achieving sustainability and increasing the quality of life of citizens.

Strategies to achieve a green city depend on the social, historical and natural context of the region and the country in which they are located. In more developed countries, initiatives are usually related to urban planning with high-tech architecture, closed industries that do not produce waste, among others. In developing countries, however, the road can begin with food security, decent work and income, a clean environment and governance that respects all citizens. Among these solutions, urban and suburban gardening stands out.

Ideologically, the green city is a broad platform of interests of many and large stakeholders, including political parties, departments, companies, citizens' initiative associations. Conflicts of interest are inevitable. Therefore, transparency and competence in decision-making are mandatory, following principles such as longevity, social equality, assessment of the full environmental value of the investment, economy, critical assessment of the needs of economic development based on the calculation of specific indicators. The transformation of the city in a green direction leads to economic, social and environmental benefits that are interrelated – says UNEP. The economic benefits of a green city, according to the UN program, include savings from the agglomeration, lower costs for building and maintaining infrastructure, and reducing the cost of pollution. In this order can be added: increased revenues from giving tourist characteristics to the city; full utilization of the agrarian potential of the city and the adjacent areas; attracting skilled labor with the achieved high quality of the living environment, which in turn increases the added value. One of the benefits of a green city, which often remains hidden due to the habit of estimating expenditure and income only quantitatively, is social cohesion. It is expressed at the level of individuals, families and social groups in urban areas and neighborhoods.

CONCLUSION

Social relationships have a positive role not only in terms of human health and happiness, but also increase the economic product – by reducing economic vulnerability in difficult times. This is especially true for disadvantaged people. The rules in this city are simple and well known, but rarely applied in our country: people are the most important in the green city, relies on environmentally friendly transport – electric and bicycle, build large green spaces, work for clean air at the expense of cars and concrete giants. The parks in the city encourage people to play sports, to spend time in nature. Properties in green neighborhoods are more expensive and people are happier in them. Green spaces increase biodiversity in cities and, last but not least, help to combat climate change. We should not forget the social role of the so-called green city –people in it are much easier to get closer to each other because they meet more often in a more natural environment. In addition, people are healthier because of better living conditions and the natural benefits of green spaces. Practice shows that the green city is the best ecosystem for the spread of high technology. This is understandable: the most qualified specialists are characterized by high mobility. They are attentive to the place where they settle and choose cities that offer a high quality of life, entertainment and amenities. The same applies to leading companies, as research proves that quality of life is among the three most important characteristics for a progressive company to choose a place for its headquarters. The realization of high technologies needs sustainable development of the environment. It is not enough to make a modern city. Society needs to change. Cities are the product of their inhabitants and their rulers. The concept of green, sustainable, self-sufficient and sustainable cities is very complex and involves a transformation in the management of modern life. Cities consume 78 % of the world's energy and produce more than 60 % of greenhouse emissions. GIS helps cities to

plan the most suitable targets for the deployment and type of green infrastructure or renewable energy sources depending on the environmental parameters and the goals set. However, we should remember that it is a gradual process and involves government, private initiative and all of us. Green cities require a real change in behavior. In conclusion, we recognize the need to implement public policies to make cities more socially and environmentally sustainable and to remedy deteriorating living conditions. To ensure that actions are lasting, it is necessary to consider: legislative frameworks, regulations, ordinances or norms; social policies and sectoral strategies; institutional frameworks and decision-making processes. In other words, systems that ensure effective, transparent and accountable governance. You cannot think of green cities without questioning the political and economic system.

ACKNOWLEDGEMENTS

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