

## Achievement of Performance and Evaluation of Green City Development Indicators for Sustainable Cities (SDGs) in 2030

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**Abstract**—Urban agglomeration and complexity are a challenge in development planning for sustainable purposes. Future urban development planning aims to integrate the principles of the environment, economy, resources, and social justice. This paper reviews the journey of implementing the green city concept worldwide. It formulates new information about the position/achievement of green city performance, especially in “medium cities” what is interesting is that it creates new discourses for researchers and practitioners about the city, especially in “medium-scale cities”. We found that successfully implementing green cities in America and the rest of Europe still has to improve performance. Countries in Asia and Africa find it difficult to meet all the attributes of a green city. Important issues that need to be considered for the study of green cities are technological innovation, green economy, and environmental control for environmentally friendly industries. Second, focus on assessing green cities in medium-scale cities, and third, model green city development strategies so that the city meets all aspects of sustainability. The performance of green city development in “medium-scale cities” is still very low; only 2 of the eight attributes of green cities are defined (AGCI). The logical consequence is the need to give special attributes to “medium cities”; therefore, research on the setting of green city attribute standards specifically for “medium cities” is interesting to study.

**Keywords**— Green cities; SDGs; sustainable development.

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### I. INTRODUCTION

A city is a territorial unit where there is a concentration of population with various types of activities, both economic, social, cultural, and government activities. This view then encourages someone to make the city a destination for activity and become a concentration of settlements which ultimately causes urbanization or the movement of people from villages to cities. Urbanization is a phenomenon caused by population movement with all its activities in a city so that the city is denser and higher than the area of origin and the surrounding area. The development of a city is closely related to population growth. Future population growth is increasing, and at the same time, resources are limited, especially land or urban space.

More than half of the world’s population is concentrated in cities [1], contributing to economic growth, innovation, and social progress [2]. The consequence is that if the urban population continues to increase. At the same time, limited urban space creates very complex urban problems, which lead to various problems, from population density, slums, garbage, limited clean water and energy, air pollution, and so on. This problem is very common in urban areas, not only in Indonesia but in several cities worldwide.

City problems are quite complex, so there needs to be a planning concept approach that leads to sustainability. The direction of future urban development planning is a development based on environmental justice (environmental sustainability), resource justice (access to resources), and social justice (comfort, health, and happiness). This concept is then called sustainable development, as reported in [3], the

around for a long time, at least starting from the World Climate Conference by the United Nations in Stockholm on 05 June 1972. The issue in the spotlight is global climate change, so every country is obliged to reduce emissions from activities in the industry. The results of the Stockholm conference have been confirmed, followed by a special session by the world environmental organization under the UNEP in Nairobi, Kenya, in 1982. The topics discussed were still related to global climate change.

The initiated by world environmental and development commission initiated WCED. The main agenda discussed/agreed upon was economic development and its relation to the environment for sustainable development. Four years later, in 1992, the United Nations held a High-Level Conference. Two thousand issues the countries gathered at the Earth Summit fought for were then developed in 2000. Issues of poverty, health, and gender equality. This issue was then emphasized in a follow-up session at the 2012 UN Summit with three main issues, namely the environment, society, and economy, as principles that must be integrated into development, especially in urban areas.

Entering 2015, the three principles of sustainable development have become the direction and development goals of countries in the world called the Millennium Development Goals (MDGs), with a target of achieving them by 2030 [4], [5]. These achievements seem to urge development agendas for the government to achieve sustainable development. The MDGs concept was refined by setting twenty priority programs for sustainable national development. The twenty priority SDG programs are a measure of the implementation of a country's sustainable development, namely human development, economic growth, population, and family planning, education, health, gender, child protection, food and nutrition, energy, maritime, infrastructure, water, sanitation environment, livelihoods, inequality, urban and rural development, governance, politics and democracy, security and defense, poverty, and global partnerships [4]. The directions and goals in the SDGs all start with population density and industrial activities. When development is uneven and unfair to all the population's interests, it will birth to social problems, including inequality, poverty, poor health, and others.

Sustainable urban development planning became popular at the end of the 20th century (since 1992), which led to the development of an ideal city from several planning objectives [3] contained in the MDGs/SDGs concept. Understanding the concept of urban planning is often termed urbanism. Urbanism is contemporarily defined as "the aesthetics of everyday life", including elements of spatial planning. The MDGs/SDGs directive that sustainable urban development (integration of three aspects) is at least able to generate income and better job opportunities, water, and sanitation, energy, transportation, equity, reduce slum areas, and protect natural assets in the city and surrounding areas.

2020 is an important period for measuring the achievement of the sustainable development agenda (SDGs) targeted in 2030. Studies on this matter are important to provide empirical data or concrete evidence of the current position of achievement of the SDG's performance [6], [7]. SDGs are also important for determining issues and priority studies for their achievement [8], especially in developed countries in

revealing the facts of the relationship between country progress and the status (achievable overall) of sustainability [9].

The Reverte [10] study highlights several dimensions of sustainable development, including economic development, socio-cultural policies, and innovation. Then Sedita [11] focuses more on the cultural aspects of urban communities where culture affects the modalities through which the state achieves sustainable development. The main configuration is the role of low government political will and high individualism.

City management is needed to plan a future fair city for the above purposes. The management approach in urban planning is related to aspects of management (planning), management, control, utilization, and also aspects of the function of a leader or leadership. Such an instrument is called the sustainable city principle (Figure 1).

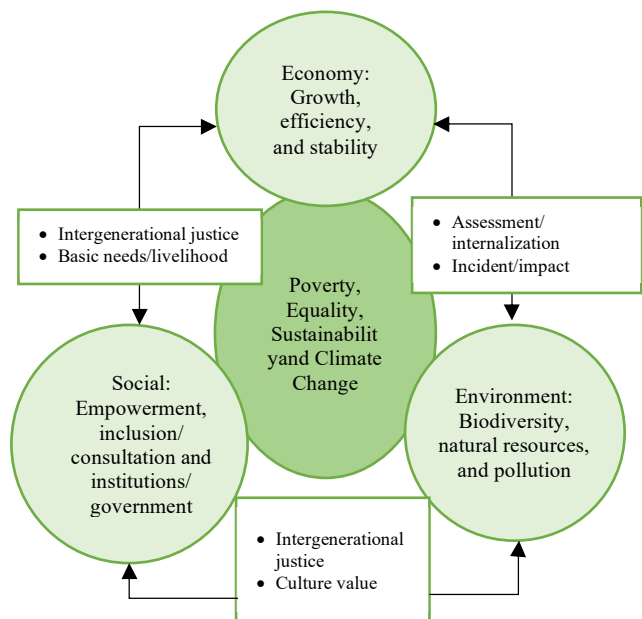


Fig. 1 Principles of sustainable development in cities [12]

City management through an urban planning approach aims to create an efficient, comfortable, and sustainable living and, ultimately, produce a sustainable development plan. The plan at least determines the location of the various activities by the government or the private sector. This approach is carried out solely for the world's sustainable development mission through a green city approach [13]. The city seeks to reduce its environmental impact by reducing waste, increasing waste recycling, reducing exhaust emissions, or increasing the area of green open space. Sustainable in all aspects of life and supports its citizens, including other elements, plants, animals, wildlife, land, water, and air quality. In line with this, it mentions the concept of healthy, ecological development, namely environmentally friendly development.

The green city concept has begun to be maximally implemented in the last decade; the authors consider the need for a study to assess the extent of achievement, specifically in cities in developing countries. Cities in developing countries have a variety of city characteristics (scale), one of which is "medium-scale cities." This study seeks to present and review

the journey of the concept and implementation of green cities worldwide. Then explore and try to find new information (newness) about the performance achievements of green cities, specifically on “medium cities”, as well as try to present a new discourse for researchers and practitioners on matters that are important issues of the position or achievement of green city performance. Finally, we try to offer points regarding the feasibility of the green city attribute, specifically “medium-scale city.”

## II. MATERIALS AND METHOD

The research uses secondary data with a review study approach or literature review. This method is carried out to answer the main objective of the study, namely evaluating the current performance (achievement) of implementing green cities and recommending appropriate indicators or attributes for medium-scale cities. The methodology is carried out systematically, explicitly, and reproducibly to identify, evaluate, and synthesize scientific works and ideas that researchers and practitioners have produced. The review study is a meta-analysis, resulting in a research position (state of the art) as the basis for research findings. The stages of the study are carried out by determining the topic and scope/limits of the study; identifying relevant and credible sources; reviewing the literature; making conclusions and interpretations directed at the interests of future studies as important issues that need to be discussed more deeply.

This study involved over a hundred journals, most of which were reputable/indexed international journals. The journal mapping results showed that the study's object consisted of 52 countries spread throughout the world from America and Latin America; Europe; Arabia and the Middle East; Africa; Asia; and Southeast Asia. It involved 66 large and medium cities, specifically in Indonesia 32 cities. Data were analyzed descriptively.

## III. RESULTS AND DISCUSSION

### A. City and Urban Concept

Cities are interpreted quite differently depending on the scientific point of view. The science of geography, the city's emphasis on the surface of the city and its environment, the relationship between regions, the city's form, and the city's function. The point of view of engineering science (engineering) will view the city as a system of urban infrastructure and its development, as well as the anatomical structure of the city and its planning. Furthermore, an architect will define a city from a point of view similar to that of an engineer. Still, in architectural science, the city emphasizes physical aesthetics with relationships between urban space and mass and their forms and patterns. This concept is better known as urban.

Greek planologist Konstantinos Apostolos Doxiadis classified cities according to population. The classification of cities according to Ekistics is Small Towns (population under 100,000), Big Cities (under 1,000,000 inhabitants, Metropolitan Cities (over 1,000,000 inhabitants; Megalopolises (more than 10,000,000); and e) The city of Ecumenopolis has a population of more than 1,000,000,000 people. The World Bank and United Nations make a

population standard for a city, namely; a) An area with a population of more than 20,000 people is called an urban (urban or small town); b) Areas with a population of more than 100,000 people are called cities (medium cities); and c) Areas with a population of more than 5 million are called big cities. In Indonesia, the classification of cities is divided into four, namely, metropolitan, large, medium, and small cities.

### B. Green Cities for Sustainable Urban Development

The early development of human activity centers (called cities) triggered industrialization activities in all sectors. This is done to meet the increasing human needs. Industrial activities (especially in urban areas) trigger environmental damage and have implications for global warming. On the other hand, human activities in cities make cities a magnet, triggering urbanization. As a result, the need for space is increasingly limited; the city is getting denser. This situation then gave birth to new problems, namely the problem of transportation density, flooding, reduction, and climate change, to the irregularity of development activities (buildings).

The irregularity of building construction activities in urban areas is the biggest challenge for sustainable development in urban areas, one of which arises from the construction sector or green buildings [14]. Facing these problems, it is necessary to have a concept of balance in the urban environment. This was introduced in 1898 by Sir Ebenezer Howard from England with the concept of a “Garden city”. A garden city is the planning and design of a city surrounded by a green belt or green natural areas of agricultural land where the proportion of urban buildings is balanced between residential areas, industrial areas, and agricultural areas [13]. This concept then developed with various terms of environmental sustainability-based urban development.

A sustainable city is an urban area that can compete successfully in global economic struggles and is also able to maintain cultural vitality and environmental harmony (a condition for a sustainable green city). The principle of aspects, as shown in Figure 1, is then refined in the concept of sustainable city planning (Sustainable City Planning), which includes four aspects: economic, social, government, and environmental [15], as shown in Figure 2.

Figure 2 shows the development of green urban planning, especially in the last two decades, by adding to the importance of governance aspects. The role of government becomes important because it is attached to the function of intervention or policy [16]. Furthermore, the role of government is considered a key element that in Western countries has been applied for quite a long time and has become a trend until now.

There are five basic principles of sustainable cities: environment, economy, equity, engagement, and energy. Furthermore, it is summarized that a sustainable city is characterized by: (a) people who care for and carry out ecologically oriented activities; (b) being able to choose when to have a lot and when to have a little; (c) social equality in the ecological aspect for the city; (d) the crisis on the environment is a crisis on creativity; and (e) ecological sustainability is not only related to local issues but also harmonizes with global issues [16].

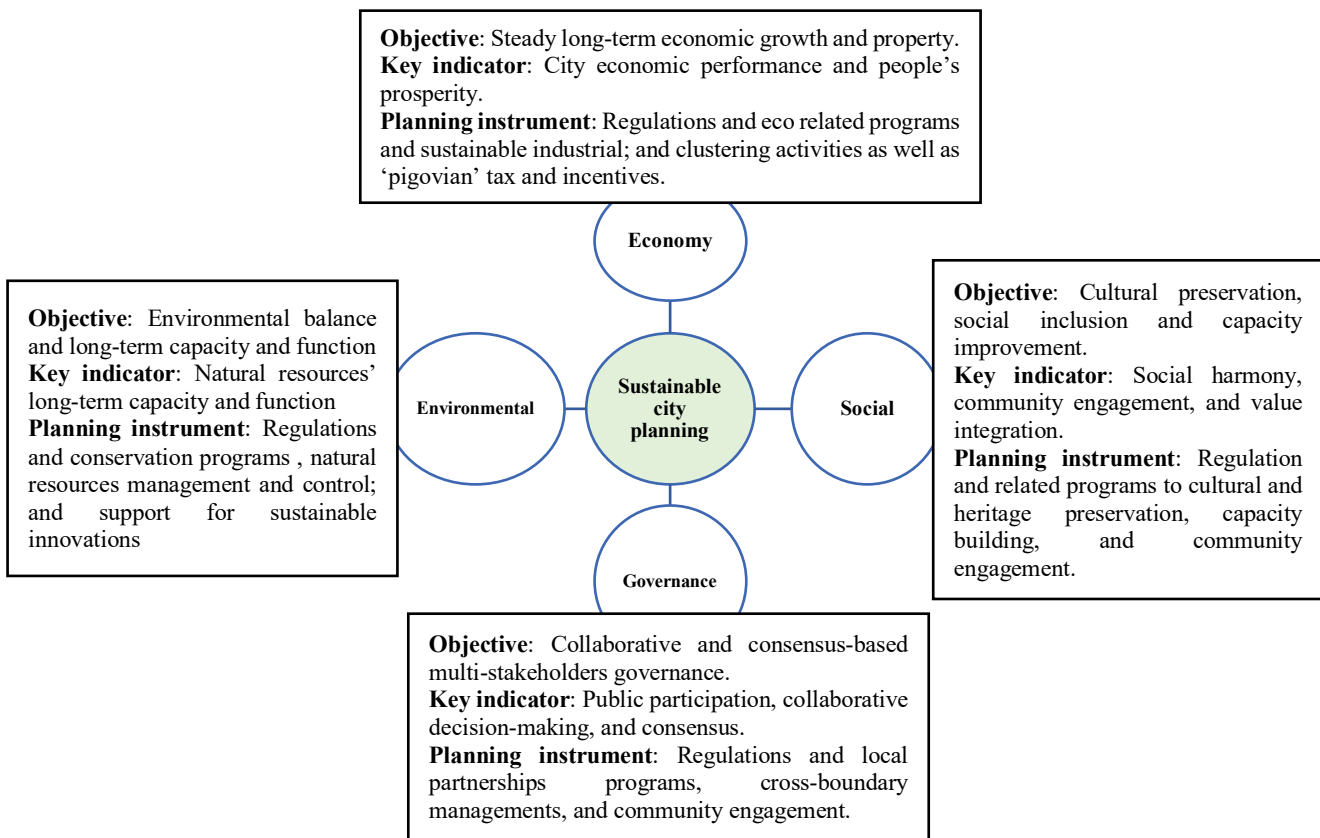


Fig. 2 Sustainable city/urban planning

Figure 3 requires that future urban development needs a paradigm reorientation where the city is a regional entity, which means the city is not only an “Engine of National and Regional Growth” but also a comfortable/livable, sustainable, and equitable city. Future-oriented city development policies must support some of these important aspects, namely

ensuring resources as “engines” of growth and formulating livable cities to be occupied as destinations for immigration. One of the important aspects is the preservation of a clean and healthy city environment. Future urban development must place more emphasis on environmental balance. The easiest thing to implement is the green city approach.

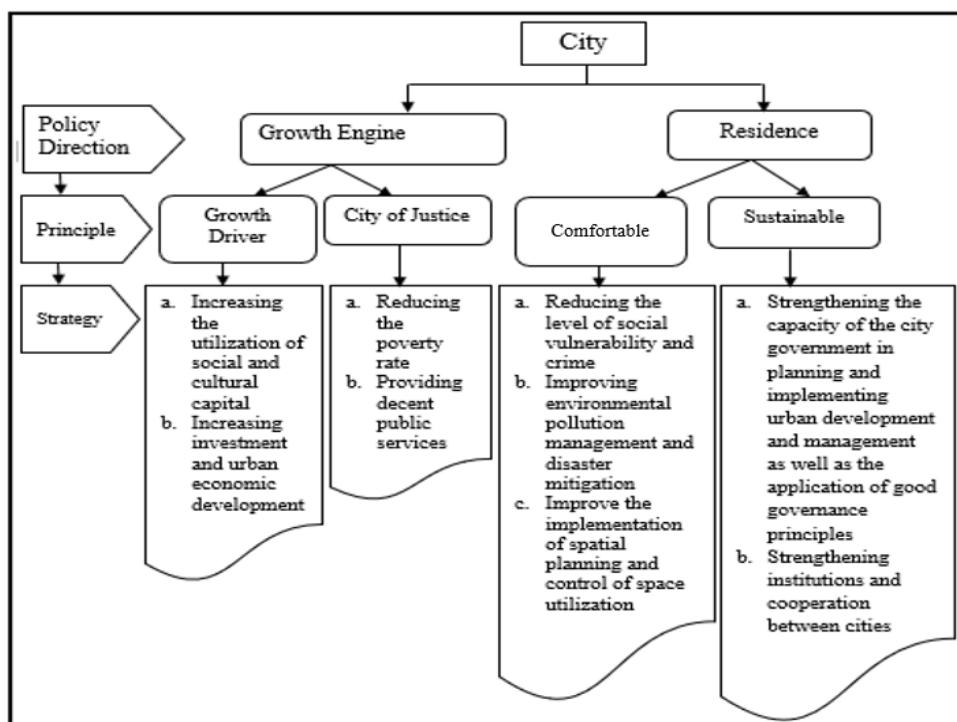


Fig. 3 Future urban development policy directions [12]

Applying a green city in some views is quite easy; it only takes full awareness of the environment in every community to carry out reforestation, starting from a small part of their homes. This small greening is done in all houses in every city; then indirectly, the city can be called a green city. Applying this kind of thinking is certainly the most optimal way today to address urban environmental problems in the future.

One of the sustainable green cities starting from the concept of Ebenezer Howard, namely: 1) Livable roads and the environment: this element combines the integration of trees, parks, open spaces, clean air from pollution; 2) Integration of community activities, such as work, living, shopping, recreational and spiritual activities placed in easily accessible zoning; 3) City boundaries are used as green belts that function to prevent city expansion; and 4) The mileage and its supporting facilities, create a comfortable atmosphere for people to walk and also support the principles of

transportation for a sustainable city. As an implication of this concept, it was introduced as a measure of green city assessment.

The four themes above were then developed into several indicators or elements of urban sustainability assessment [1], [17]. Those studies illustrate the conceptual framework of sustainable development as the basis for 67 initiatives. The framework offered further constructs research to offer the concept of achieving sustainable development through a green city. The concept base starts from a sustainable city, with three achievement domains, namely sustainability from environmental, social, infrastructure, and economic aspects. The four domains gave birth to twelve themes for the realization of sustainable development in urban areas, namely water, air, land use, energy, greenhouse, and emission (CO<sub>2</sub>), economic welfare, waste, transportation, health, community, neighborhood, and government (shown in Figure 4).

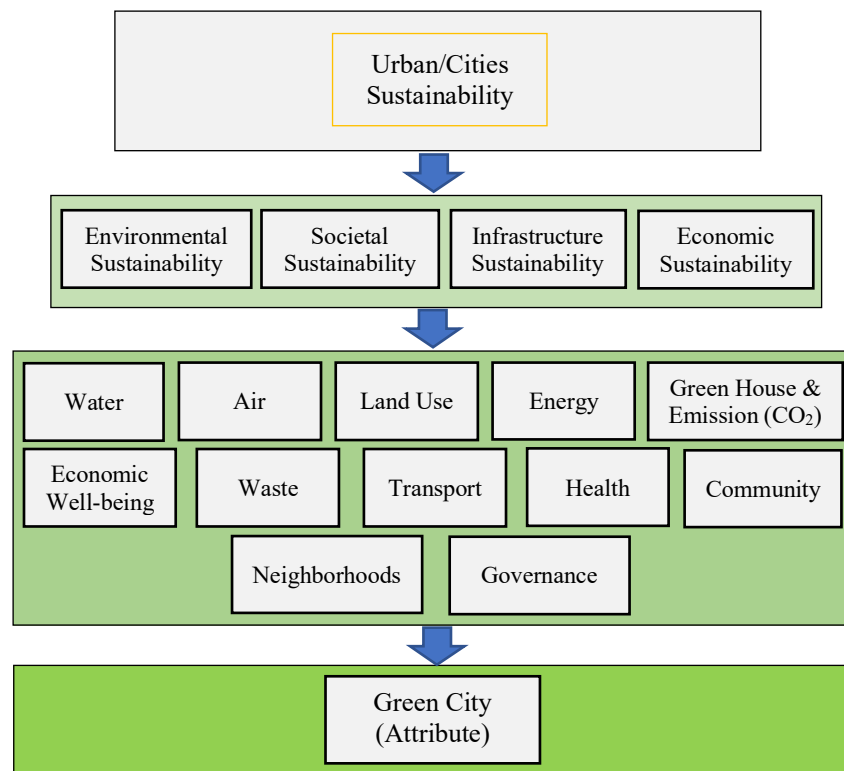


Fig. 4 Conceptual Framework for sustainable urban development

### C. Green City Assessment Index for Sustainable City Development

There are several instruments used in assessing or measuring green city performance. The instrument is called the green city attribute and is generally used by several studies in the world. There is an index called the US/Canada Green City Index, which the United States and Canada have used since 2011. Europe commonly uses the Environmental Performance Index (EPI) measurement index, then there is the European Green City Index, which has been implemented since 2009. Apart from using the two indices in Germany, they have also internally made the German Green City Index since 2011. African countries have used the African Green City Index since 2011, and Asia has the Asian Green City Index. The EPI index defines two categories and nine attributes, as shown in Table 1.

TABLE I  
INDICATORS AND CATEGORIES OF GREEN CITY ENVIRONMENTAL PERFORMANCE ASSESSMENT WITH EPI

No.	Category	Attribute	Indicator
1.	Protection of human health from environmental damage	Child Mortality	Child Mortality
		Air Quality	Household air quality and air pollution
2.	Ecosystem vitality	Water and Sanitation	Access to Drinking Water and access to sanitation
		Climate and Energy	CO <sub>2</sub> emission in KWh and change of carbon intensity.
		Biodiversity and Habitat	Critical habitat protection, marine protected area, global biome protection, national biome protection
		Fisheries	Fish stocks and coastal shelf fishing pressure
		Forests	Change in forest cover

No.	Category	Attribute	Indicator
		Agriculture	Pesticide regulation and agricultural subsidies
		Water Resources	Wastewater treatment

The assessment of green cities in European countries uses several approaches (indexes), including the Urban Ecosystem Europe (UEE) index. Europe generally uses the Urban Ecosystem Europe (UEE) assessment index to assess green cities, consisting of 6 attributes and 25 indicators, as presented in Table 2.

TABLE II  
ASSESSMENT OF GREEN CITIES IN EUROPE WITH THE INDEX URBAN ECOSYSTEM EUROPE (UEE)

No.	Category/Attribute	Indicator
1.	Health and naturalness of public facilities	Air quality (NO <sub>2</sub> , and PM <sub>10</sub> ); Acoustic Environment; Water (domestic water) consumption; and water (inhabitants served by water treatment plants).
2.	Responsible choices and lifestyle	Energy (electric consumption variation); Waste (amount of municipal waste produced); Waste (municipal waste processed according to differentiated refuse collection schemes); and Green public.
3.	Better planning, design and mobility, and traffic control (reduction and shifting of private transport to public transport)	Transport (public transport within the urban area; underground and train lines in the urban area; the number of vehicles registered in urban areas; availability of bicycle lanes in urban areas); Green areas and land use; and availability (wide) of green open space and public space.
4.	Energy and climate change	Energy consumption and CO <sub>2</sub> regulation; Availability of solar power plants, especially in public areas and other public facilities); Energy (energy service system up to the sub-district level); and energy (energy saving policies and climate change mitigation).
5.	Vibrant, sustainable local economy and social equity, justice and cohesion	Demographic dependence and old age; Protection of female employment; and Population qualified at the highest level of education
6.	Local management towards sustainable governance	EMAS and ISO 14001 certification of public authorities; Level of implementation of Agenda 21 processes; Electorate voting in city elections; and City representatives who are women.

The attributes of a green city assessment by the European Green City Index (EGCI) consist of 8 attributes with 30 indicators. This index started in the application in 2009. The eight attributes are Green CO<sub>2</sub>; Green Energy; Green Buildings; Green Transport; Green Water; Green Waste and land use; Green Air quality; and Environmental governance.

The fourth approach used by European countries is SDG-11. This attribute has been used since 2016, and it is targeted that all indicators will be achieved by 2030 by the sustainable development goals (SDGs), especially indicators 11.5.1 and

11.b.2. The UN Statistical Commission determined seven attributes/categories of green city assessment in the SDG 11 index in seven (7) green city assessment achievement targets in 2030, namely: 1) Fulfillment of basic household services; 2) A safe, affordable, easily accessible transportation system for all social classes to children, persons with disabilities, and the elderly/elderly; 3) Sustainable settlements (slum management); 4) Cultural heritage protection; 5) life expectancy index, economic resilience (gross domestic product) and disaster mitigation, especially for vulnerable groups; 6) Maintaining air quality, and waste management; and 7) Availability of green open spaces and safe public spaces for all social classes.

Cases in Asian countries use green city attributes through the Asian Green City Index (AGCI) with eight attributes and 29 indicators. Judging from the indicators have similarities with European countries. AGCI was introduced and implemented in 2011 in countries in Asia. The eight attributes of a green city defined by AGCI are shown in Table 3 [18], [19], [20].

TABLE III  
GREEN CITY ATTRIBUTE ASSESSMENT WEIGHT ACCORDING TO THE ASIAN GREEN CITY INDEX (AGCI)

No	Category/Attribute	Indicator
1.	<i>Energy &amp; CO<sub>2</sub></i>	Policies/programs for implementing green energy for emission control/reduction (CO <sub>2</sub> ); Solar energy implementation plan; Wind energy implementation plan; Water energy implementation plan; Energy implementation plan from waste; and Plant energy application plan.
2.	<i>Land Use and Buildings</i>	Area of green open space (%); Population density (people/km <sup>2</sup> ); and Eco-building policy.
3.	<i>Transport</i>	Land use policy for transportation; The total length of the urban mass transport network; Urban mass transportation policy; and Policies in decomposing congestion.
4.	<i>Waste</i>	Waste generated (m <sup>3</sup> ); Waste managed or collected (m <sup>3</sup> /day); Waste recycling policy; and Garbage collection policy.
5.	<i>Water</i>	Total water consumption per capita (liters/person); Water system leakage (%); Policies to improve water quality; and Policies to manage water resources efficiently.
6.	<i>Sanitation</i>	Communities already have latrines (%); Amount of liquid waste that can be managed (%); and Sanitation policy.
7.	<i>Air Quality</i>	Daily nitrogen dioxide levels (ug/m <sup>3</sup> ); Daily Sulfur dioxide levels (ug/m <sup>3</sup> ); and Daily suspended particulate matter levels (ug/m <sup>3</sup> ).
8.	<i>Environmental Governance</i>	Management of the environment; monitoring; and participation

Standards by the AGCI are similar to those used by European countries (European Green City Index/EGCI). This cannot be separated from the condition that some countries in Asia have entered into developed and modern countries/cities. The City of Jakarta, Surabaya, Semarang, Makassar, Depok, Bogor, Bekasi, Bandung, South Tangerang, Tangerang,

Palembang, Pekanbaru, and Medan uses the use of AGCI Index in Indonesia. Some cities in Indonesia also use the Green City Development Program (P2KH) index [19], [21]. The P2KH scoring index is similar to the AGCI; the difference is only in some indicators.

#### D. Green City Implementation Performance to Achieving Sustainable Cities

The study of Brilhante and Klaas [15], [19] took the case of 50 cities in 29 countries. The results of his study classify the performance achievements of green cities into three achievement clusters, namely the top/highest, medium, and low achievements. Later studies were supported by other studies by Ayik *et al.*, and M.L., Derkzen *et al.* [15], as presented in Table 4.

TABLE IV  
GREEN CITY PERFORMANCE

No.	Cluster	City	Performance (%)
1.	Top	Vancouver, Copenhagen, Auckland, Melbourne, Toronto, Amsterdam, Berlin, San Francisco, London, Rotterdam, Paris, Boston, Barcelona, Eindhoven, Heerlen, Greater Sidney, and Valencia	30-33
2.	Medium	Brisbane, Nev York City (NYC), Tokyo, Singapore, San Diego, Taipei, Zagreb, Moscow, Los Angeles, Curitiba, Hong Kong, Makati, Dubai, Bogota, Sao Paulo, Shanghai, and Beijing	22-29
3.	Low	Leon, Rio de Janeiro, Cape Town, Buenos Aires, Guadalajara Metro, Nairobi, Jakarta, Mumbai, Johannesburg, Bengaluru, Riyadh, Mexico City, Accra, Amman, Delhi, and Lagos	18-21

Furthermore, Brilhante and Klaas [15] showed attributes with the highest percentage were sanitation, air quality, optimization of green water use, and transportation. The lowest green city attributes are waste, socioeconomic, green open space, and land use, and the lowest is CO2 and energy.

Cities that perform well (top) in applying green cities are generally big cities in Europe and Australia. Medium ratings were found in most cities in America, Europe, Australia, and Asia, while low-performing ratings were found in cities in mainland Asia, America, and Africa. This fact shows that large cities in Europe have succeeded in applying the attributes of green cities, while other cities in the world with moderate and low performance are spread across Asia, a small part of the Americas, and Africa. This means that the performance to achieve the status of a sustainable city still needs to be improved and is still an important issue that must be worked on by several big cities worldwide.

The results of the Brilhante and Klaas study [15] align with the findings [18] that countries in Asia, Africa, and Latin America as tropical regions have not been able to fulfill all the attributes of a green city. Furthermore, Brilhante and Klaas's study [15] analyzed 30 journals in 12 cities spread across eight countries in the world, associated with the results of the study [22] that for the case of cities in the Americas such as Brazil,

Chile, Colombia, Ecuador, and Mexico. The attribute of green cities, performance needs to be improved on economic, governance, environmental, and social issues. These results align with research [23] that Latin American cities need to harmonize economic, social, and environmental development to achieve successful sustainable cities. Supporting Brilhante and Klaas's research on cities in African countries [24], [22] as in Kenya and Nigeria, the attributes of green cities that improve performance are in the social, environmental, and governance aspects.

The results of a study Brilhante and Klaas study [15] in cities in Asian countries generally have moderate and low performance, in conjunction with a study [22] that low-performance achievements in the social, economic, and environmental, and governance sectors can cause medium and low performance. In the case of Indonesia, Bangladesh, and India, issues that need to be improved in the performance of green cities are social, economic, environmental, and governance. These four issues have also become recommendations for sustainable green cities in China by previous researchers such as Permana and Harsanto [22]. Even further, they suggest that cities in Asia as developing countries must emphasize plans through an environmentally friendly mission and urban planning that encourages other private sectors' participation [25].

In particular, cities in the Arab Region, Iran, and the UAE (United Arab Emirates) for green city sectors/attributes that are of concern to improve their performance are social, economic, environmental, and governance [22]. On this basis, [16] in their study mention that the cities of Arab countries (Middle East) that are the core of sustainable urban planning are economic, social, and justice, cultural and historical values, and most importantly, environmental protection.

In the case of developing countries such as Indonesia, green cities' performance has not met the sustainability aspect. Results of studies in 67 journals in 32 cities, it was found that only a small proportion has met the performance standards of green cities such as Tangerang City, South Tangerang City, Bogor City, Depok City, Surabaya City, and Jakarta according to the above-average value 28% [19]. The rest is still far from the minimum percentage of green city performance achievements, both from the average value and performance per green city attribute/indicator. This study is also supported by the study of [21], which shows the performance of green cities in Indonesia has not been maximized (reaching the required minimum standards).

#### E. Performance of Green Cities in Indonesia in "Medium-Scale" Cities

Green city assessment according to city classification (metropolitan, big city, medium city, and small city) is almost found in all countries, including the United States [26], [27]. The study of Borck and Pflüger [26] found that urbanization and trade have implications for urban environmental problems, furthermore finding a dichotomy between big and small cities, including suburbs, in the development of green cities in the United States. The study of Borck and Pflüger [26] makes it important to develop green cities, both in big and small cities, so that city development activities align with efforts to control environmental damage.

The classification of green city ratings according to the city scale is also reinforced by Winter's [28] opinion in his study, which states that the city of Copenhagen, as the greenest city in the world, still finds gaps (contradictions) in the development of green cities. There are at least three contradictions found, namely cities with privileges (class), suburbs (city scale in which there are suburbs and small towns), and disincentives (measurement).

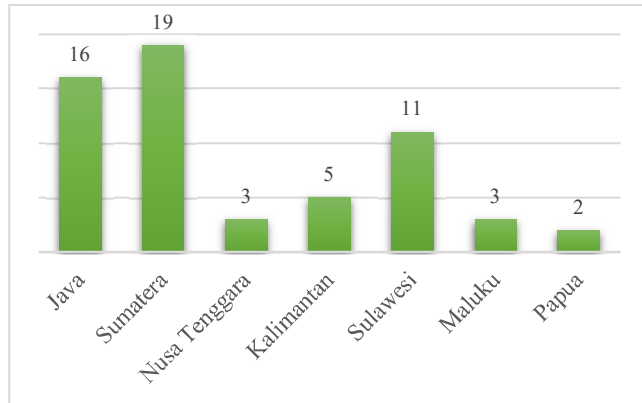


Fig. 5 Number of medium cities and regional distribution in Indonesia

The scope of the city study referred to in this article is the City Government in Indonesia which is included in the “medium city” category with a population of >100,000-500,000 people. Cities in Indonesia with a “medium city” scale are about 59 cities nineteen (19) cities are spread across Sumatera, 16 cities are spread across Java, three cities are spread across Nusa Tenggara, five cities are located in Kalimantan, 11 cities are spread across Sulawesi, three cities in Maluku, and two cities in Papua.

Studies on the assessment of green city performance in “medium cities” are very limited, if any are generally still partial, namely the performance on each attribute using either the AGCI index or the P2KH index. The review studies (journals) results related to implementing green cities until 2022 are 13 cities. As a result, the object of study is still focused on green open space or land and building use and green communities.

The only study conducted related to the assessment of green city performance in the case of “medium cities” was in Batu City [18], in which his study concluded that the implementation of green cities according to P2KH standards/attributes did not meet the required standards. This study was supported by several other studies, such as in Mamuju City, Ambon City, Gorontalo City, Palu City, Manado City, Kupang City, Mataram City, including Banda Aceh City; and the city of Yogyakarta, the area of TRH is still below 20%. Furthermore, the study showed that green open space is uncomfortable (thermal comfort from the temperature-humidity index/THI is uncomfortable). Then studies [3] showed that green open space in Kendari City has not been able to provide ecological functions in terms of controlling microclimate and greenhouse gas effects.

The analysis results of the twelve (12) study object cities that two cities have met the minimum area of green open space performance above 30%, namely the City of

Bukittinggi and the City of Bengkulu. The analysis results (literature review) also found attributes of a green city that had fulfilled the green community and environmental governance. The cities that meet the AGCI and P2KH standards in the “medium city” case are the City of Bukittinggi and the City of Banda Aceh.

The study's results above illustrate the challenges of implementing or developing green cities in “medium cities” because only two attributes are feasible to be developed from the AGCI and P2KH standards, namely land and building use; and green communities. The green city assessment study on the “medium city” is very limited (only one); as well as being one the new information (novelty) that the attributes of a green city that deserve to be maximized are two attributes, namely, land and building use; and environmental management), while other attributes still need further study. The author's provisional conclusion is that evaluating “medium-scale cities” special attributes is necessary by prioritizing two indicators as a standard for assessing green cities. The authors emphasize this as an important discourse and issue that needs to be discussed by experts and practitioners about the attributes and indicators of green city development, especially in “medium-scale cities”.

#### F. Green City Development Position and Important Future Research Issues

State-of-the-art represents a research space or position that is considered “empty”. This void becomes the scope of analysis (problem formulation) and opportunities for new research that has not been investigated or discovered by previous research. The research position (state of the art) is constructed from the results of empirical research to find important things or points that need to be updated or, wherever possible, the results of this study support the theory or are in line with empirical research friends related to the preparation of green city attributes and efforts in realizing every attribute to be able to achieve a sustainable city.

According to several studies, some attributes of green cities are obtained as keywords for future green city development planning: 1) Metropolitan cities are still trapped in environmental, social, green open space, waste, water, and transportation issues. So this requires a special approach both from the aspect of government and technology application (innovation); 2) Improved performance on all attributes of green cities from both AGCI and P2KH, especially in medium-scale cities; 3) Increasing the physical aspects of buildings and open spaces by integrating socio-cultural aspects for the comfort and happiness of city residents; 4) There needs to be a system integration of all attributes of a green city; 5) Open areas and the like (green building, green transportation, and open space) have not been able to function in controlling emissions (air quality); 6) Unfulfilled green open space; and 7) In the future, it is necessary to formulate models and strategies for achieving green city performance by considering aspects of feasibility and city classification (metropolitan, big, medium, and small cities). State of the Art is built from relevant empirical studies or previous research, as presented in Table 5.



TABLE V  
STATE OF THE ART

Green City Index	Recommended Analysis Objects	State of the Art
AGCI, EGCI, and SDG-11	<ol style="list-style-type: none"> <li>Maximizing two attributes (Green planning &amp; design and Open green space)</li> <li>Improved performance on all attributes</li> <li>Increasing the physical aspect of open space, the comfort aspect, and the happiness of the city residents</li> <li>Introducing seven conceptual frameworks for measuring Green Cities (from IHS-GCCF)</li> <li>Future studies for applying green cities to aspects of economic sustainability through innovation and technology.</li> </ol>	<ol style="list-style-type: none"> <li>There are similarities between several attribute indicators for assessing green cities by EPI, AGCI, and P2KH in Indonesia, so there needs to be a new formulation by integrating all the indicators referred to.</li> <li>Green city assessment based on seven (7) IHS-GCCF conceptual frameworks (Institute for Housing a Green City Conceptual Framework)</li> <li>Technological innovation in developing green cities is mainly economic, including environmental control through environmentally friendly industries (environment and air quality).</li> <li>Focus on green city assessment on “medium-scale cities.”</li> <li>There needs to be a strategic model for achieving green city performance on all attributes so that city functions can fulfill all sustainability aspects.</li> </ol>
EPI, UEE, and EGCA	<ol style="list-style-type: none"> <li>Numerical/scoring system assessment to assess green city performance.</li> <li>Area arrangement (green planning and design); RTH; and Green Infrastructure</li> <li>System integration of all green city attributes</li> <li>Introducing the seven Institute for Housing a Green City Conceptual Framework (IHS-GCCF) conceptual measurement frameworks</li> <li>For future studies on the application of green cities to aspects of economic sustainability through innovation and technology and evaluating the impact of environmentally friendly industries on profits and long-term economic growth (environment and air quality)</li> <li>There needs to be an assessment of the performance of green cities in “small and medium cities.”</li> </ol>	
Developing Countries and “Medium-Scale Cities”	<ol style="list-style-type: none"> <li>Green open space has not provided an ecological function and provides comfort, performance improvement and optimization of waste and energy management</li> <li>Added (use all) green city attribute.</li> <li>Integration of all attributes for big cities and metropolitans</li> <li>Attributes that meet two aspects, namely land use and buildings; and environmental governance/green community.</li> <li>Application of Green City as an innovative step to solve urban problems</li> </ol>	
Green City Strategy Model for Sustainable Cities	<ol style="list-style-type: none"> <li>Achieving a sustainable city must implement and integrate all the attributes of a green city.</li> <li>Sustainable Urban Forms/Models on all attributes</li> <li>The resulting model can be adopted in other organizations or sectors to produce a better model</li> </ol>	

Source: [29], [30], [31], [22], [19], [18], [32], [26], [28]

From the mapping results, important issues are obtained in planning and developing green cities for sustainable city development as shown in state of the art (research position) above. Five important issues need to be observed for the study of green cities, namely: a) There are similarities in some of the attribute indicators for the assessment of green cities by EPI, AGCI, and P2KH in Indonesia, so there needs to be a new formulation by integrating all the indicators referred to; b) Green city assessment based on seven (7) IHS-GCCF conceptual frameworks (Institute for Housing a Green City Conceptual Framework); c) Technological innovation of green cities, especially in the economic aspect, including environmental control through environmentally-friendly industries (environment, and air quality); d) Focus on green city assessment in medium-scale cities; and e) For the sake of integration (point a), have a strategy model for achieving green city performance on all attributes so that city functions can truly fulfill all aspects of sustainability.

The five important issues above add to the new discourse and become the second novelty, especially for further researchers to deepen the study of this research. This information is also important for further research to follow up on the research position (state of the art). The third focus of attention (novelty) is a green city performance assessment study specifically in “medium-scale cities”. This becomes important to follow up and strengthen the results of studies that have been previously reviewed, which conclude that the achievement is still low. The hope from the research that the writer hopes is that there is a need to determine special attributes and indicators in “medium-scale cities”.

#### IV. CONCLUSION

Sustainable urban development has started in the last three decades, driven by European/Western countries due to the industrial revolution since the 1990s. Meanwhile, the implementation of green cities to achieve sustainable (city) development began in the last decade. The analysis results show that the performance of green cities for sustainable cities in America and Europe generally has met the minimum standards. However, some cases still do not meet the attributes/indicators of green cities, so they still need to be improved. Some indicators that have not been met include waste, socioeconomic, green space, land use, and the lowest is CO<sub>2</sub> and energy. This shows that the application of green cities in developed countries is still being developed and improved to meet the level of sustainable cities.

The case of cities in Latin America, Asia, the Middle East, and Africa only started to be implemented in the early 2000s, so, naturally, the performance of green cities is still in the “medium” category in the sense that the attributes have not been able to meet the standards set. Especially for Southeast Asian countries where the city is generally classified as a “medium scale” city, the results were found that they still cannot fulfill all the attributes of a green city. It is a challenge for developing countries, especially in Asia, and Southeast Asia, including Indonesia, to improve the performance of green cities.

According to the results of the analysis, the green city development implemented tends to have similarities in terms of indicators applied by several countries, both from Europe

(EPI), Asia (AGCI), and specifically Indonesia (P2KH). In maximizing green city performance, the researchers offer several concepts that must be followed up. First, the green city assessment is based on seven (7) IHS-GCCF (Institute for Housing a Green City Conceptual) conceptual frameworks. Second, technological innovation, especially economic, includes environmental control and environmentally friendly industries. Finally, the need for studies focusing on green city assessments in medium-scale cities is interesting and gets special emphasis. This is based on several studies which conclude that “medium-scale cities” still cannot meet the attributes of a green city.

Conceptually, these points are conceptual implications for further research to follow up on state-of-the-art studies, and practically this information becomes a consideration for the government to review the implementation of green cities according to city classification. This is what will attract further research to be bolder in determining the attributes and indicators of green cities that are appropriate or suitable specifically for “medium cities”.

In accordance with the position of the study described above, there are at least three key statements that have conceptual/theoretical implications; First, the attributes of green cities have not fully met the application of green cities in all parts of the world, so this needs further discussion to assess the weaknesses of implementing green cities. Second, five important issues need to be followed up on for green city development (as mentioned above). Third, for the case of a “medium-scale city,” the achievement is still very low, namely only two of the specified attributes (AGCI 8 attributes). The logical consequence is that there needs to be a special attribute determination for “medium-scale cities” because the characteristics of large and metropolitan cities are certainly different from “medium cities”. Research on setting standards for green city attributes specifically for “medium cities” is interesting.

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