



## Optimizing Green Governance Through Green Dynamic Capability and SDGs Local Action Plans: An Empirical Analysis Towards Surabaya Green City

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### ABSTRACT

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Rapid urbanization is leading to complex environmental challenges, including ecosystem degradation and increased carbon emissions. Surabaya, as a metropolitan city in Indonesia, faces challenges in maintaining a balance between economic development and environmental sustainability. This study aims to analyze the role of GDC and SDGs Local Action Plan in optimizing Green Governance City to achieve Local SDGs Performance. This study uses a quantitative approach with a cross-sectional survey method of Surabaya city government employees who have a role in the planning and implementation of green policies. The data was analyzed using PLS-SEM. The results of the study show that GDC and SDGs Local Action Plan have a significant effect on Green Governance City and local SDGs performance. In addition, Green Governance City contributes to the achievement of Local SDGs Performance. This study provides insight for local governments in designing more adaptive and innovation-based Green City policies. The practical implication is that cities that want to accelerate the transformation towards a Green City need to strengthen green capabilities and develop a sustainability strategy based on the SDGs Local Action Plan.

## 1. INTRODUCTION

Cities have long been the center of civilization, economy, innovation, and social and cultural development. Today, more than 50% of the world's population lives in urban areas, and this figure continues to increase rapidly [1]. Urbanization of urban areas accelerates environmental degradation, air pollution, and hydrogeological disasters. Jakarta, for example, has high levels of air pollution due to transportation, industrial emissions, and limited green space [2]. In the last two decades, Southeast Asia has lost 40-60% of its urban green space, impacting biodiversity as well as carbon sink capacity [3].

Green transformation approaches and sustainable urban governance are the main solutions. Green infrastructure such as vertical gardens and tree canopy cover of at least 30% can reduce the ambient temperature and improve air quality [4]. Singapore and Copenhagen have managed to reduce emissions by up to 40% in a decade through progressive policies, green technology, and community participation [5, 6]. Green governance practices play an important role in the efficient management of natural resources and the implementation of long-term environmental policies [7]. This model includes institutional innovation and decentralization, as in the Hindu Kush Himalayan region [8], and a participatory approach to increase community engagement [9].

Indonesia, a developing country with a population of more than 270 million people, faces the challenges of rapid urbanization, climate change, and environmental degradation

[10]. The government adopts Green City initiatives to create a healthier urban environment [11]. Surabaya (Figure 1), as the second largest metropolitan city in Indonesia, has implemented environmental policies and green infrastructure with green open spaces (RTH) reaching 21.99% of the total area, absorbing 642,794.59 tons of CO<sub>2</sub> per year [12]. However, urbanization has led to a 30% conversion of green land in the past two decades, triggering annual flooding and increased air pollution [13]. In addition, high municipal waste production requires better management [14]. The imbalance between commercial expansion and green infrastructure is a challenge in maintaining sustainability [15].



Figure 1. Location map of Surabaya-Indonesia city [16]

Green Dynamic Capability (GDC) and the SDGs Local Action Plan play an important role in integrated regional green governance. GDC is the ability of an organization to integrate and build internal and external competencies to adapt to changing environments [17]. GDC encourages green innovation and strengthens urban sustainability through the integration of green policies in urban planning [18]. On the other hand, the SDGs Local Action Plan provides a strategic framework for local governments to face social, economic, and environmental challenges [19]. The implementation of the SDGs, especially SDG 11, which aims to create inclusive and sustainable cities, requires a multi-stakeholder approach and the strengthening of green infrastructure [20]. The success of the implementation of GDC and RAL-SDGs can be seen in the Bristol model, which emphasizes community involvement [21] and an evidence-based approach in Sydney [19]. Studies show that GDC drives green innovation and sustainable development while technology readiness strengthens sustainability performance [22]. In Sweden, the adoption of the concept of green growth is limited due to political and institutional inconsistencies [23], while in China, digitalization improves the performance of green innovation [24].

Studies have highlighted the role of GDC and the SDGs Local Action Plan in supporting urban sustainability. However, there is still a gap in understanding the integration of these two concepts in the context of urban green governance. Previous studies focused more on the application of individual Green Dynamic Capabilities in the manufacturing sector or the implementation of the SDGs Local Action Plan in local policies without examining their strategic synergies. In addition, research is still limited to developed countries such as the United Kingdom and Finland, while implementation in developing metropolises such as Surabaya has not been widely studied. Based on the existing background and gaps, this study aims to analyze the integration of GDC and SDGs Local Action Plan to encourage green governance practices in supporting the achievement of Local SDGs with the study of the Surabaya Green City Area.

## 2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

### 2.1 Green governance: Principles and implementation for sustainable city

Green governance is a governance framework that integrates environmental policies into decision-making processes to balance economic, social, and environmental interests [25, 26]. This approach integrates environmental aspects with economic and social interests and involves a wide range of stakeholders from local to global levels in decision-making [27]. The green governance approach has several main principles that must be adhered to by public and private sector users. The green governance approach demands resource management that not only meets current needs but also ensures continuity for future generations [28]. Active participation from various parties, including the government, the private sector, and the community, is a key element in creating inclusive and equitable governance [29]. Long-term planning that considers potential future environmental challenges is also an important part of green governance [30]. In addition,

environmental policies must be integrated with economic and social aspects in order to create comprehensive governance [31]. In its implementation, transparency and accountability are needed so that every policy made can be accounted for and ensure that decision-making takes place openly [32]. Participatory decision-making must be carried out inclusively and in accordance with local wisdom and integration with environmental education to support knowledge-based policies [33]. Flexibility in dealing with environmental changes is a crucial factor that allows this governance system to remain relevant with the times [34]. In addition, the aspect of justice in the distribution of environmental benefits must also be considered so that there is no inequality in access to resources and the impact of environmental policies [35].

Green governance in city governance emphasizes the implementation of policies and practices that support environmental sustainability and effective management of urban green spaces. Municipal governments have a central role in sustainable environmental planning and management, as they can directly influence development policies and provide public services related to waste management and environmental protection [36]. In practice, various strategies are implemented to strengthen green governance, such as Green Management Practices (GMP), which utilize online services to reduce budgets and environmental impacts [37], and the Chain Leader System (CLS) in China, which integrates the industry with sustainability goals through stakeholder communication and green clustering [38].

Key challenges in urban green governance include a lack of cross-sector coordination, limited financial resources, and the increasing involvement of the private sector in the distribution of ecosystem services, which can affect equitable access for communities [39, 40]. One approach that can be used is the ecosystem services framework, which has proven effective in green space planning and in increasing public awareness of the benefits of sustainability [41]. In addition, digital technology can strengthen the effectiveness of environmental governance by optimizing industrial structures, increasing public participation, and encouraging innovation in resource management [42]. Case studies in Milan and Berlin show that public-private collaboration models and the implementation of ecosystem-based strategies can be a solution to the challenges of urban green governance [43, 44]. By strengthening aspects of collaboration, policy adaptation, and coordination between stakeholders, local governments can play a strategic role in supporting sustainable and environmentally friendly development.

The challenge of green governance in urban Southeast Asia is rooted in the tension between economic growth and environmental sustainability [45]. In contrast to Europe, which has implemented strict regulations in the green economy, ASEAN countries still face obstacles in cross-sector coordination and policy implementation [46]. Studies in China show that environmental rights-based approaches and community participation can improve the effectiveness of green governance [47], something that is still under-implemented in Southeast Asia due to weak civil society involvement and the dominance of state actors. In addition, rapid urbanization in Southeast Asia is leading to environmental degradation similar to the cases in India and China, where technology-based approaches have been tested but face economic and social challenges [48].

## 2.2 Localizing SDGs through policy and strategy: The role of local governments

The SDGs (Sustainable Development Goals) are a global agenda agreed by 193 UN member states in 2015 to overcome social, economic, and environmental development challenges until 2030 [49]. Designed as a continuation of the MDGs (Millennium Development Goals), the SDGs aim to create an inclusive, equitable, and sustainable world with the principle of "leaving no one behind." The SDGs have 17 global goals agreed by UN member states to address the world's major challenges, such as poverty, inequality, climate change, and environmental damage, with the goal of achieving prosperity for all by 2030 [50]. The SDGs cover various aspects, ranging from education and health to peace and justice.

In local issues, the SDGs are important to be implemented at the local government level to ensure that development policies and programs are in line with the specific needs and challenges of local communities [51]. The implementation of the SDGs at the local level involves coordination between various parties, including local governments, the private sector, and communities, to ensure social, economic, and environmental sustainability [52]. The implementation of the SDGs locally can strengthen community resilience, improve the quality of life, and reduce inequality at the local level [53]. The local SDG approach requires local governments to adopt policies that are based on national and regional frameworks. The use of logical methodologies, such as logical frameworks, has proven effective in defining sustainability-focused goals and analyzing consistent policies [54]. In areas such as Goulburn-Murray, Australia, the analysis of interactions between the SDGs helps identify synergies and trade-offs that guide local policies [55].

There are major challenges in the implementation of local SDGs, including unplanned urban growth, poor public services, a lack of policy integration, and limited resources [56, 57]. Localities also need to adapt the SDGs to their specific needs through multi-stakeholder participation and the application of technologies such as Geographic Information Systems (GIS) for spatial-based planning [58]. Education for sustainable development (ESD) and capacity building are also very important in supporting community engagement and the achievement of the SDGs at the local level [59].

The integration of the SDGs into urban development policies is essential to ensure that urban planning and infrastructure development are aligned with sustainability principles. The implementation of the SDGs in urban policies not only provides strategic guidance in the preparation of spatial planning, resource management, and inclusive development of public spaces but also helps optimize the efficiency of budget use and strengthen environmental protection [60]. Aligning regional development planning policies with SDGs targets, such as improving environmental quality, reducing poverty, and increasing access to basic services [61]. In these conditions, the ability of local governments is also a crucial factor. Local governments that have good managerial and technical capacity are able to formulate, implement, and evaluate development policies holistically so that challenges such as unplanned urban growth and resource limitations can be effectively addressed [57, 62]. Strengthening internal capacity allows local governments to design, implement, and evaluate development policies that are responsive to local dynamics and support the achievement of the SDGs. With this integrative approach, the global targets of

the SDGs can be translated into real transformations at the local level, improving the quality of life and well-being of urban communities.

## 2.3 Integrated underpinning theory

Dynamic Capability Theory (DCT) and Institutional Theory (IT) are two important theories in the study of organizations. DCT, developed by Teece, Pisano, and Shuen [63], focuses on an organization's ability to adapt, respond to environmental changes, and innovate sustainably to achieve competitive advantage. DCT emphasizes the importance of dynamic capabilities—the ability of organizations to transform and adapt their internal resources and processes to respond to external opportunities and threats. In urban governance, DCT explains how city governments and related agencies can develop the capacity to respond to rapid changes, such as demographic changes, community needs, or environmental challenges [64]. This dynamic capability allows cities to design and implement innovative, sustainable policies, as well as adapt strategies to changing conditions. For example, in the face of rapid urbanization, cities can adapt spatial planning, infrastructure, and transportation policies to create a more inclusive and environmentally friendly environment [65, 66]. DCT provides the foundation for creating a more flexible urban system that is ready to face future challenges.

Meanwhile, Institutional Theory (IT), which is often associated with the social dimension of organizations, suggests that the actions and decisions of organizations are influenced not only by market or competition factors but also by the norms, rules, and pressures that exist in the institutional environment in which they operate [67, 68]. IT highlights how organizations are influenced by conformity to the rules and norms that exist within their social environment, thus fostering stability and homogeneity among similar organizations. In striving for the Sustainable Development Goals at the local level, IT reflects the importance of institutional policies in accelerating the achievement of these goals. Public policies adopted by municipalities are often influenced by the norms and rules that apply in society as well as pressure from various interest groups, such as civil society, international institutions, or the private sector [69, 70]. Policies that follow global best practices or international guidelines, for example, in terms of climate change or natural resource management, can foster convergence and homogeneity in sustainable development efforts [71]. Conformity to these rules and standards creates stability that supports more effective long-term policy implementation.

## 2.4 Hypothesis development

Sustainable urban development requires the effective implementation of Green Governance. This study examines how GDC and the implementation of the SDGs Local Action Plan contribute to the optimization of green governance in Surabaya as a Green City.

The concept of GDC is getting more and more attention in the sustainability literature, especially in relation to green innovation and the achievement of sustainable performance. GDC refers to an organization's ability to adapt, build, and manage internal and external competencies to cope with dynamic environmental changes [17, 72]. GDC in city government refers to the ability to develop and utilize dynamic capabilities in achieving sustainable and environmentally

friendly city management [73]. Some of the key components in the development of these capabilities include green intellectual capital and ecological innovation, which are essential for creating a green competitive advantage, as well as transformational leadership that plays a role in facilitating communication between stakeholders [74, 75]. In addition, green innovations that focus on environmentally friendly technologies and practices are also important in supporting sustainable development. These dynamic capabilities also include resilience and flexibility in municipal government, which include the ability to face unexpected challenges and adapt to changing environments. Collaboration between stakeholders and an effective governance framework are also key factors in strengthening green infrastructure and urban resilience [76].

GDC also plays an important role in supporting the implementation of the Sustainable Development Goals (SDGs) through a collaborative governance structure. GDC, which includes an organization's ability to integrate and adapt sustainability practices, has been shown to enhance green innovation and support sustainable development [77, 78]. Studies show that organizations with strong GDCs are better able to adopt local action plans for the SDGs, especially through innovation and long-term sustainability strategies. In the context of governance, stakeholder engagement, and multi-sector partnerships are essential in the implementation of the SDGs [79, 80]. Governance models that support collective participation and coordination between the public, private, and civil society sectors are proven to accelerate the achievement of the SDGs at the local level [81].

Recent empirical studies show that GDC in local/city governments has a significant influence on green governance. A study by Fan et al. [18] highlights that regional digitalization in China enhances local green innovation through the enhancement of dynamic capabilities such as sensing, seizing, and reconfiguring. In addition, the managerial capacity of local governments has proven to be a mediator between financial investment and the implementation of green economy strategies [82]. Local governments' focus on environmental issues significantly increases the productivity of the total green factor (GTFP) and encourages green technology innovation and urban efficiency [83]. In developing countries, GDCs play a role in the adoption of green innovation, with big data analytics capabilities strengthening this relationship [17]. Green transformational leadership and green service excellence contribute to product and process innovation of industries and regulators, with GDC as the main mediator and determinant [84, 85]. Another study also highlights the importance of GDC in driving the achievement of the SDGs. Studies in G7 countries show that green innovation can hinder the relationship between economic factors and the SDGs, although, in the long term, it still supports environmental and social sustainability [86]. In addition, stringent environmental policies and financial development in Sub-Saharan Africa and Central-Eastern Europe have proven to support green innovation and carbon mitigation in line with the SDGs [87, 88].

Based on previous studies, this study forms an understanding that the GDC of the city government plays a role in encouraging the implementation of sustainable urban governance and also directly affects the SDGs' urban performance. Therefore, this study formulates the first and second hypotheses with the following statements.

**Hypothesis 1.** *GDC has a significant positive effect on Green Governance City.*

**Hypothesis 2.** *GDC has a significant positive effect on Local SDGs Performance.*

The SDGs Local Action Plan plays an important role in addressing global challenges with a community- and regional-based approach [89]. Local governments have a key role in implementing the SDGs by adjusting strategies to the specific needs of local communities [90]. The integration of the SDGs into local policies allows for more tangible and measurable change. The success of local action plans is highly dependent on the availability of resources, careful planning, and collaboration between governments, the private sector, and civil society [91]. In addition, effective monitoring and evaluation methods are needed to measure policy impact and ensure sustainable implementation of the SDGs [92].

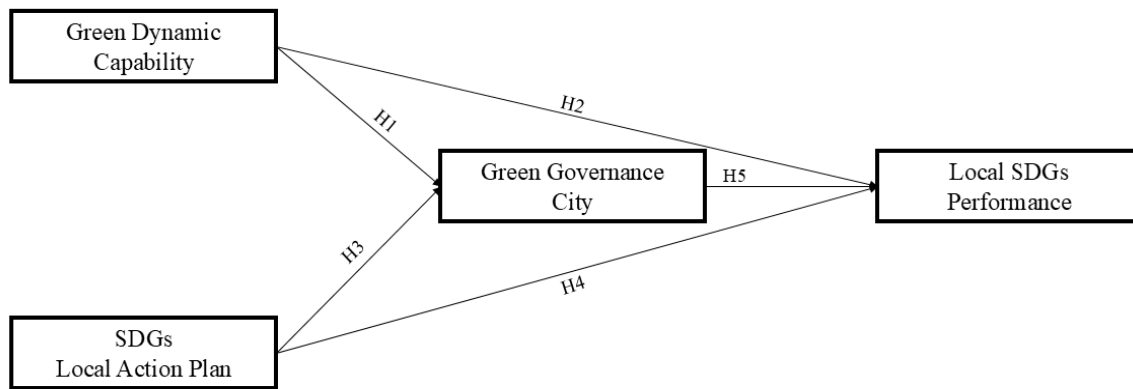
Recent empirical studies show that the SDGs Local Action Plan contributes to green governance by improving the efficiency of government services, transparency, and environmentally friendly practices such as energy efficiency and waste management [85]. The implementation of the SDGs requires multi-level governance that accommodates global and local interests [93]. Key factors for sustainability success include reliable resources, effective planning, competent local actors, and trust between stakeholders [89]. Although the SDGs influence policy discourse, normative and institutional impacts such as legislative changes are still limited [94]. A multi-level governance approach is needed for the integration of the SDGs in local strategies [93].

On the other hand, SDG policy planning has also been found to play an important role in achieving sustainable development targets. Gustafsson and Ivner [95] stated that the integration of the SDGs into existing policy strategies is necessary to avoid ineffective parallel processes. A systematic analysis in the European Union shows that coherent policies, adjustments to local indicators, and the integration of the SDGs in education are key factors in achieving the targets [96]. In addition, access to domestic and international funding contributes significantly to community practices, although they do not yet fully support environmental practices [97]. Technology and economic progress are the main drivers in increasing the SDGs composite index. At the same time, the use of multi-source data helps to overcome the limitations of regional statistical data in the evaluation of SDGs achievement [98]. At the business level, a company's commitment to certain SDG groups affects business results, with trade-offs that must be managed to optimize positive impacts [99]. Studies also show that initiatives such as the Belt and Road Initiative (BRI) contribute to poverty reduction (SDG 1), especially in upper-middle-income countries [100].

Based on previous studies, this study builds the perception that the SDGs Regional Action Plan implemented by the city government contributes to the strengthening of sustainable urban governance and is likely to affect local urban SDGs performance directly. Therefore, the third and fourth hypotheses in this study are formulated as follows.

**Hypothesis 3.** *SDGs Local Action Plan has a significant positive effect on Green Governance City.*

**Hypothesis 4.** *SDGs Local Action Plan has a significant positive effect on Local SDGs Performance.*



**Figure 2.** Research model purposed

Green Governance City integrates environmental sustainability in urban planning through technology, green infrastructure, and community participation. Smart Sustainable Governance focuses on transparency, accountability, and the use of technologies such as IoT and AI to improve the efficiency of city services [101]. Green Infrastructure (GI) plays an important role by integrating natural ecosystems in urban development to support environmental sustainability [102]. The main challenge in the implementation of Green Governance is socio-economic differences. Cities in developed countries are more willing to invest in GI, while developing countries face rapid urbanization [103]. Its success depends on the collaboration of governments, the private sector, and communities in providing sustainable ecosystem services [39]. AIoT technology also encourages data-driven governance to optimize resources and reduce environmental impact [104].

Recent empirical studies show that local green governance plays an important role in achieving the Sustainable Development Goals (SDGs). In a study of cities in China, improved low-carbon governance contributed significantly to economic growth and environmental sustainability through technological innovation and reduction of carbon intensity, especially in areas with moderate population density and low dependence on resource extraction [105]. In addition, research on heavy industry companies shows that increased pressure on the achievement of environmental targets at the local level drives improved ESG performance, driven by green technology innovations and media attention [106]. The co-creation approach in local green governance is also considered crucial, where the involvement of various stakeholders through collaboration and innovation can accelerate the sustainability transition [107]. The Australian study further highlights eight modes of local government engagement in the SDGs, affirming the transformative potential of local governance in realizing sustainability [89].

With previous empirical evidence, this study predicts that green governance cities can encourage local SDG performance. Therefore, the third hypothesis in this study is formulated as follows.

**Hypothesis 5.** *Green Governance City has a significant positive effect on Local SDG performance.*

The proposed theoretical framework of this research is presented in Figure 2.

## 3. RESEARCH METHODOLOGY

### 3.1 Research design

This study uses a quantitative approach with a cross-sectional empirical survey method in the Surabaya-Indonesia Green City Area as the unit of analysis. This method was chosen because it allows the collection of representative information on green capabilities and policy practices for the implementation of urban green governance in line with sustainable development goals. In this study, the selected respondent units are city government employees, including officials and staff of related agencies who have a role in planning, implementing, and evaluating environmental policies and green governance. The selection of these respondents is based on the consideration that they have a deep understanding of policies, challenges, and factors that affect the success of Green Governance City. In addition, as the main actors in decision-making and implementation of environmental policies, their perspectives are key in identifying patterns, relationships between variables, and key factors that contribute to the optimization of green governance in developing countries.

### 3.2 Measurement of variable

This study measured four main variables with a total of 34 indicators, which were developed based on previous studies and validated through Focus Group Discussions with academics and public policy experts. The research instrument was a questionnaire consisting of five parts. The questionnaire was measured using a 5-point Likert scale, from "strongly disagree" (1) to "strongly agree" (5). The first part of the questionnaire introduces the background of the research, aiming to provide respondents with an understanding of the purpose and content of the questions. The second to fifth sections contain items that measure each of the main variables. The second part measures GDC with 10 indicators, reflecting the government's role in innovative policies, civil servant training, monitoring of green projects, and cross-sector partnerships [108-110]. The third part assesses the SDGs Local Action Plan through 10 indicators, including implementation strategies, policy education, and community participation in sustainable development [111-113]. The fourth part evaluates the Green Governance City with four indicators, which reflect the governance of green space and the transparency of environmental policies [114-116]. Meanwhile,

the fifth part measures Local SDG performance with 10 indicators, which assess the effectiveness of SDG policies in improving people's welfare and the application of environmentally friendly technologies [117-119].

### 3.3 Population and sample size

The population in this study is comprised of civil servants (PNS) in the city of Surabaya who meet certain criteria. The sampling technique was determined by purposive sampling, with the criterion that respondents must have the status of permanent civil servants and at least five years of work experience. Referring to the guidelines put forward by Hair et al. [120], the minimum number of samples is determined to be five times the number of indicators in the study. With 34 indicators, the number of samples needed in this study is at least 170 respondents.

In addition to this method, the number of samples was also estimated using G\*Power analysis with the model "linear multiple regression: Fixed model,  $R^2$  deviation from zero" [121]. The parameters applied include an effect size of 0.15 (medium category), a significance level (alpha error probability) of 0.05, a power of 0.8, and three independent variables. Based on the results of the analysis (Figure 3), the minimum number of respondents needed in this study is 77 people.

### 3.4 Data collection and statistical analysis

Data collection was carried out directly from May to July 2024 by involving enumerators who conducted field visits. Respondent data was obtained through the Human Resources Section of the Surabaya City Government to ensure that participants were in accordance with the research criteria and had relevance to the topic being studied. This research follows ethical standards by maintaining data anonymity and security, obtaining official permission before implementation, and providing clear information about the research objectives and participant rights. Prior to the data collection process, each respondent is required to provide written consent, with the assurance that their confidentiality and privacy will be protected.

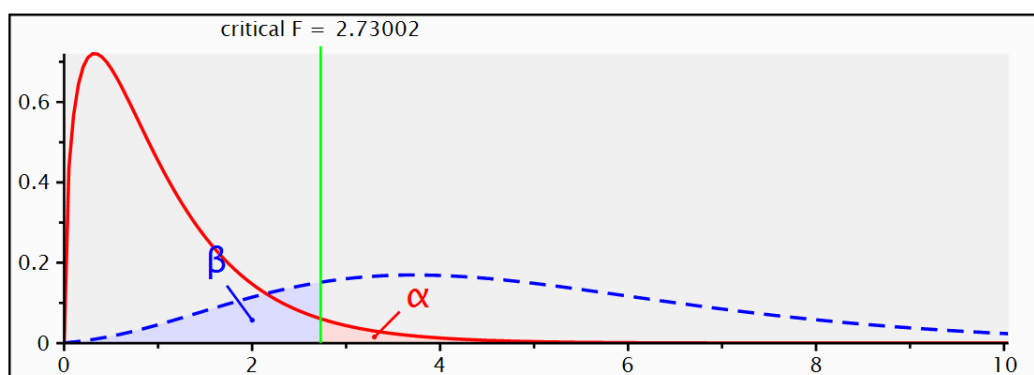
In the initial stage, the study succeeded in collecting data from 242 respondents, consisting of civil servants in the city of Surabaya who were willing to participate. However, after going through the verification process, a number of data did not meet the criteria due to incomplete profile information or inconsistencies in filling out the main questionnaire. After screening, the number of valid and analyzable respondents was

217 people, resulting in an effective response rate of 89.67%. Details of respondent characteristics are shown in Table 1.

**Table 1.** Characteristics respondent

| Characteristic             | Total | Percentage |
|----------------------------|-------|------------|
| <b>Gender</b>              |       |            |
| Man                        | 43    | 20%        |
| Woman                      | 174   | 80%        |
| <b>Age</b>                 |       |            |
| 18-30 Years                | 91    | 42%        |
| 31-45 Years                | 77    | 35%        |
| 46-59 Years                | 49    | 23%        |
| <b>Functional Position</b> |       |            |
| Expertise                  | 145   | 67%        |
| Skills                     | 72    | 33%        |
| <b>Service Period</b>      |       |            |
| 5 Years                    | 126   | 58%        |
| 5-10 Years                 | 33    | 15%        |
| More than 10 Years         | 58    | 27%        |

This study applies Partial Least Squares Structural Equation Modeling (PLS-SEM) with the help of SmartPLS 4 to test the research model and confirm the hypothesis. The PLS-SEM method was chosen because of its ability to analyze complex causal models and still generate reliable estimates even though the data had an abnormal distribution [122]. This approach is very relevant for exploratory research that aims to predict and understand the relationship between variables [123]. PLS-SEM was chosen for this study due to several key advantages over alternative statistical techniques. First, PLS-SEM is highly suitable for complex models with multiple latent variables and indirect relationships, making it an ideal choice for analyzing green governance dynamics [124]. Second, it is robust to small sample sizes and does not require a strict assumption of normal data distribution, unlike covariance-based SEM (CB-SEM), which relies on large samples and multivariate normality [125]. Additionally, PLS-SEM excels in predictive research, allowing for the estimation of not only relationships but also the explained variance in dependent variables [126]. This is particularly useful in understanding the contribution of GDC and SDG Local Action Plans to governance performance. Finally, PLS-SEM allows for formative and reflective constructs, providing flexibility in measurement models. Given these strengths, PLS-SEM provides a more reliable and insightful approach compared to traditional regression analysis or CB-SEM for exploring the causal mechanisms underlying urban sustainability governance.



**Figure 3.** G\*Power minimum sample number estimation graph

The analysis process is carried out in two stages. The measurement model (outer model) aims to measure the validity and reliability of a construct, ensuring that the indicators used truly reflect the concept being researched [127]. Furthermore, the structural model (inner model) evaluates the relationship between variables and their impact on the implementation of Green City. To improve the accuracy of the results, bootstrapping techniques were applied to test the statistical significance of the relationship in the research model [128].

## 4. RESULT

### 4.1 Measurement outer model

In the early stages of this study, an in-depth evaluation of the measurement model was carried out before testing the hypothesized relationship. This process focuses on examining important aspects, such as multicollinearity, reliability level, and convergent validity and discrimination.

In measuring the measurement model and convergent validity, indicators such as Alpha Cronbach, loading factor, average variance extracted (AVE), and composite reliability (CR) are used. The test results in Table 2 show that the loading factor exceeds 0.60, and the CR is higher than 0.70 [129]. The AVE value also exceeds 0.50 for each construct [129]. To identify multicollinearity, a Variance Inflation Factor (VIF) analysis was carried out, with the results of all indicators having a VIF value below 5, which indicates that there is no multicollinearity problem in the measurement model [130].

This study evaluates the validity of construct discrimination using three approaches (Table 3): Fornell-Larcker (FLC), Heterotrait-Monotrait ratio (HTMT), and cross-loading indicators; although FLC is effective in some conditions, this method does not always identify weaknesses in the validity of the discrimination [131]. Therefore, this study combines FLC and HTMT ratios for a more comprehensive analysis. The results showed that there was no problem with the validity of discrimination based on FLC, and the HTMT value was below the threshold of 0.90, meeting the criteria [125, 131].

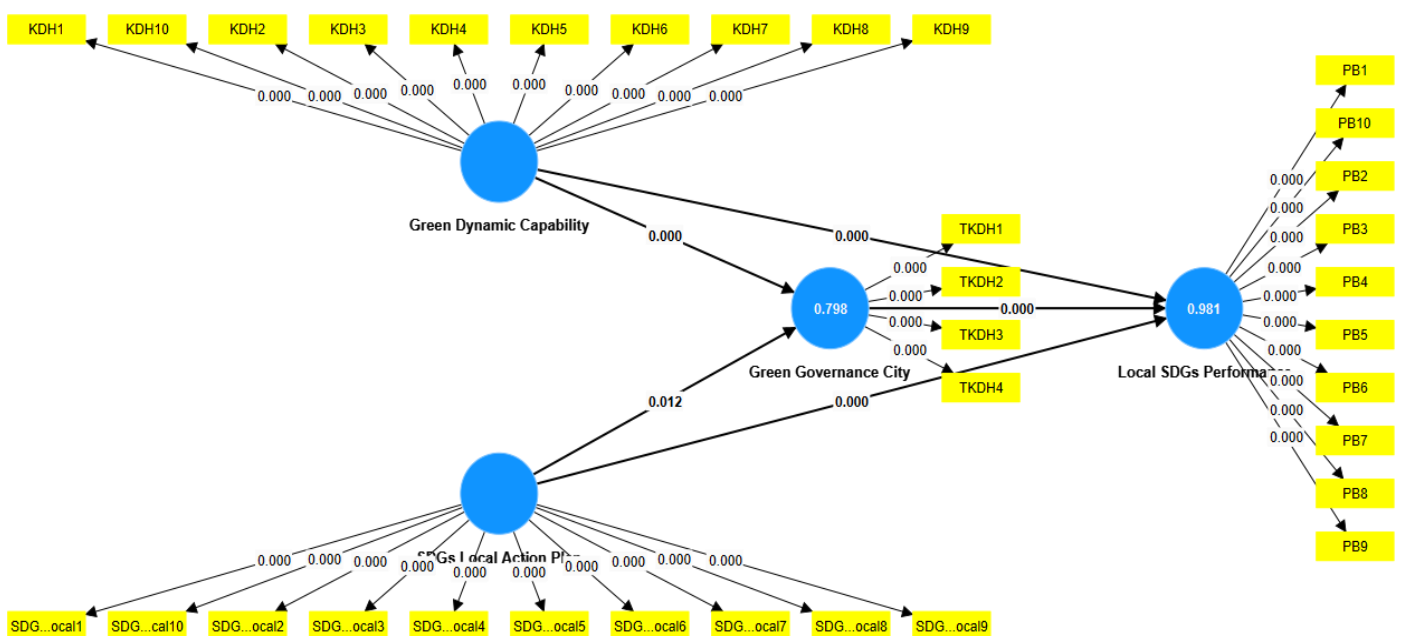
**Table 2.** Reliability, convergent validity, and multicollinearity

| Variable Indicator                                                                                                                            | Loadings Factor | AVE   | CA    | CR    | VIF   |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------|-------|-------|-------|
| <i><b>GDC</b></i>                                                                                                                             |                 |       |       |       |       |
| The City Government plays an active role in designing and implementing innovative policies related to Green City development                  | 0.781           |       |       |       | 2.564 |
| We, as City Civil Apparatus, regularly participate in training on the concept and application of Green City                                   | 0.760           |       |       |       | 2.543 |
| There is a structured monitoring and evaluation system to ensure the sustainability of environmentally friendly projects                      | 0.798           |       |       |       | 2.770 |
| The city government builds strategic partnerships with various institutions to strengthen the implementation of green cities across sectors   | 0.714           |       |       |       | 1.960 |
| The use of renewable energy is applied in the operational activities of government offices and public facilities                              | 0.809           | 0.524 | 0.895 | 0.915 | 2.642 |
| Commitment to environmentally-based policies is demonstrated through concrete steps in city governance                                        | 0.752           |       |       |       | 1.386 |
| Waste and waste management systems are implemented efficiently to reduce negative impacts on the environment                                  | 0.789           |       |       |       | 2.317 |
| Education programs and socialization of green technology are routinely carried out to increase public awareness                               | 0.740           |       |       |       | 1.577 |
| The government encourages the public and private sectors to adopt business practices oriented towards environmental sustainability            | 0.734           |       |       |       | 1.748 |
| The development of environmentally friendly technology continues to be encouraged to support the achievement of sustainable development goals | 0.765           |       |       |       | 2.357 |
| <i><b>SDGs Local Action Plan</b></i>                                                                                                          |                 |       |       |       |       |
| The City Government actively educates and disseminates policies related to the SDGs to all government apparatus                               | 0.768           |       |       |       | 2.230 |
| The City Government has strategic initiatives and programs that are systematically designed to achieve the SDGs targets                       | 0.754           |       |       |       | 2.120 |
| The implementation of SDGs-based policies has contributed to improving people's welfare and quality of life                                   | 0.715           |       |       |       | 2.121 |
| The preparation of SDG policies at the local level is adjusted to the needs and socio-economic conditions of the people of Surabaya           | 0.762           |       |       |       | 2.406 |
| The local government ensures that there is an allocation of sufficient resources to support the implementation of SDG policies                | 0.843           | 0.509 | 0.890 | 0.909 | 2.385 |
| The synergy between government agencies in Surabaya is going well in an effort to realize sustainable development goals                       | 0.772           |       |       |       | 2.751 |
| Community participation is an integral part of the planning process and implementation of SDG policies at the local level                     | 0.837           |       |       |       | 2.083 |
| Evaluation and monitoring of SDG policies are carried out periodically with the principles of transparency and accountability                 | 0.710           |       |       |       | 2.720 |
| SDGs-based development policies have encouraged the use of environmentally friendly technology to create sustainable cities                   | 0.830           |       |       |       | 2.786 |
| The city's efforts to achieve the SDGs are focused on reducing social and economic disparities to create a more inclusive society             | 0.724           |       |       |       | 1.644 |
| <i><b>Green Governance City</b></i>                                                                                                           |                 |       |       |       |       |

|                                                                                                                                                                                   |       |       |       |       |       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|
| The City Government establishes firm and structured policies for managing and maintaining the sustainability of green open spaces (RTH)                                           | 0.862 |       |       |       | 2.306 |
| Collaboration between local governments, community organizations, and the private sector runs synergistically in efforts to preserve and manage green areas                       | 0.827 |       |       |       | 2.021 |
| To encourage innovation and The application of environmentally friendly technology in green space governance, the government provides various forms of adequate incentives        | 0.887 | 0.733 | 0.878 | 0.917 | 2.700 |
| Budget management and resource allocation for green areas are carried out with the principles of openness and accountability to ensure the effectiveness of policy implementation | 0.848 |       |       |       | 2.210 |
| <b>Local SDGs Performance</b>                                                                                                                                                     |       |       |       |       |       |
| I consider that the implementation of a Green City has played a role in improving the efficiency of natural resource utilization in my work environment.                          | 0.706 |       |       |       | 1.800 |
| The sustainable development program implemented by the city government has proven to have a positive impact on improving people's welfare.                                        | 0.744 |       |       |       | 2.351 |
| I feel that I have a direct contribution to the implementation of local actions that support the achievement of the Sustainable Development Goals (SDGs) in my area of work       | 0.807 |       |       |       | 2.743 |
| Policies prepared by the City Government have succeeded in encouraging sustainable economic growth in this region                                                                 | 0.768 |       |       |       | 2.334 |
| Community awareness and involvement in preserving the environment is increasingly increase                                                                                        | 0.778 |       |       |       | 2.157 |
| The use of information and communication technology (ICT) in public services has improved the effectiveness and ease of access for the public                                     | 0.774 | 0.520 | 0.894 | 0.914 | 1.621 |
| I am confident that the principles of sustainable development applied have strengthened the competitiveness of this city, both at the national and international levels           | 0.762 |       |       |       | 1.737 |
| Training and skill improvement programs initiated by the government have helped increase the work capacity and productivity of the state civil apparatus                          | 0.787 |       |       |       | 2.543 |
| Sustainability initiatives managed by the City Government have created new business opportunities and diversified sources of community income                                     | 0.749 |       |       |       | 2.505 |
| I feel that there has been real progress in environmental infrastructure since the implementation of various sustainable development policies                                     | 0.764 |       |       |       | 2.249 |

**Table 3.** Discriminant validity

| <b>Heterotrait-Monotrait Ratio</b> |            |                              |                               |                               |
|------------------------------------|------------|------------------------------|-------------------------------|-------------------------------|
|                                    | <b>GDC</b> | <b>Green Governance City</b> | <b>Local SDGs Performance</b> | <b>SDGs Local Action Plan</b> |
| GDC                                |            |                              |                               |                               |
| Green Governance City              | 0.671      |                              |                               |                               |
| Local SDGs Performance             | 0.701      | 0.636                        |                               |                               |
| SDGs Local Action Plan             | 0.745      | 0.556                        | 0.567                         |                               |
| <b>Fornell-Larcker Criterion</b>   |            |                              |                               |                               |
| GDC                                | 0.981      |                              |                               |                               |
| Green Governance City              | 0.932      | 0.856                        |                               |                               |
| Local SDGs Performance             | 0.889      | 0.840                        | 0.961                         |                               |
| SDGs Local Action Plan             | 0.724      | 0.795                        | 0.721                         | 0.713                         |



**Figure 4.** PLS bootstrapping

**Table 4.** Hypothesis path testing results

| Hyp. | Path Coefficient                                | Beta ( $\beta$ ) | T-Statistics | P-Values | Decision | F <sup>2</sup> |
|------|-------------------------------------------------|------------------|--------------|----------|----------|----------------|
| H1   | GDC → Green Governance City                     | 1.121            | 13.179       | 0.000    | Accepted | 0.814          |
| H2   | GDC → Local SDGs Performance                    | 0.762            | 15.372       | 0.000    | Accepted | 2.207          |
| H3   | SDGs Local Action Plan → Green Governance City  | 0.249            | 2.506        | 0.012    | Accepted | 0.240          |
| H4   | SDGs Local Action Plan → Local SDGs Performance | 0.330            | 7.924        | 0.000    | Accepted | 0.720          |
| H5   | Green Governance City → Local SDGs Performance  | 0.099            | 4.313        | 0.000    | Accepted | 0.304          |

## 4.2 Inner model structural

After the measurement model is validated, the analysis continues with the evaluation of the structural model to test the hypothesis using the bootstrapping technique with 5000 subsamples via Smart PLS [128]. The hypothesis testing results in Table 4 and Figure 4 show that GDC has a positive and significant influence on Green Governance City ( $\beta = 1.121$ ,  $p < 0.001$ ,  $f^2 = 0.814$ ), supporting H1 with a large effect size. Additionally, GDC also strongly contributes to Local SDGs Performance ( $\beta = 0.762$ ,  $p < 0.001$ ,  $f^2 = 2.207$ ), confirming H2 with a very large effect size. The SDGs Local Action Plan was found to have a positive relationship with Green Governance City ( $\beta = 0.249$ ,  $p = 0.012$ ,  $f^2 = 0.240$ ), supporting H3 with a moderate effect size. Furthermore, the SDGs Local Action Plan also has a significant impact on Local SDGs Performance ( $\beta = 0.330$ ,  $p < 0.001$ ,  $f^2 = 0.720$ ) thus H4 is accepted with a large effect size. Moreover, Green Governance City has a positive relationship with Local SDGs Performance ( $\beta = 0.099$ ,  $p < 0.001$ ,  $f^2 = 0.304$ ), supporting H5 with a moderate effect size.

The variation described in each endogenous variable is measured through the  $R^2$  value (Table 5). A high  $R^2$  value indicates an effective model in explaining these variables [122]. Based on the results of the analysis, Green Governance City has an  $R^2$  of 0.798 and an Adjusted  $R^2$  of 0.796, indicating an excellent model. Local SDGs Performance has an  $R^2$  of 0.981 and an Adjusted  $R^2$  of 0.981, showing that the model explains almost all variations of these variables. A  $Q^2$  value greater than zero indicates good predictive power [122]. Green Governance City has a  $Q^2$  of 0.783 and a Local SDGs Performance of 0.964, indicating a very high predictive relevance.

**Table 5.** Construct cross-validated redundancy

| Variable               | $R^2$ | $R^2$ Adjusted | $Q^2$ |
|------------------------|-------|----------------|-------|
| Green Governance City  | 0.798 | 0.796          | 0.783 |
| Local SDGs Performance | 0.981 | 0.981          | 0.964 |

## 5. DISCUSSION AND IMPLICATION

### 5.1 Discussion

This study seeks to analyze the relationship between GDC, SDGs Local Action Plan, and Urban Green Governance, as well as its impact on Local SDG performance in Green City Planning Areas. In general, the results of this study reinforce the hypothesis that has been designed in a theoretical framework and reveal the complex relationship between GDC, SDGs Local Action Plan, and Urban Green Governance and their impact on the achievement of SDGs Performance at the local level.

The results of the hypothesis test show that GDC plays a crucial role in strengthening Green Governance City (H1) and

significantly contributes to the achievement of Sustainable Development Goals (SDGs) at the local level (H2). The substantial effect size in H1 highlights that GDC is a dominant driver of green governance effectiveness, reinforcing policy adaptability, cross-sector collaboration, and environmental innovation. Meanwhile, the exceptionally high effect size in H2 suggests that GDC has a profound impact on local SDGs performance, positioning it as a key enabler for sustainable urban transformation. Although these results are in line with previous research [18, 82, 83, 85, 86, 88], The main value of this study lies in a more detailed explanation of how GDC not only strengthens Green Governance City through increased policy flexibility and responsiveness but also plays a key role in achieving local SDGs. Strategically, this shows that cities with dynamic green capabilities are able to internalize sustainability principles into governance, turn regulations into concrete actions, and build sustainable ecological competitiveness. The success of dynamic green capabilities in strengthening Green City governance indicates that flexibility in environmental innovation, adaptive response to ecological changes, and cross-sector collaboration are key factors in increasing the effectiveness of sustainable policies. Simultaneously, the direct influence on the achievement of local sustainable development goals proves that strengthening green capabilities is not only an improvement in governance but also an accelerator that creates a real impact on ecological balance, social resilience, and economic sustainability.

In line with previous research in the domain of sustainability governance and the implementation of local SDGs in various regions [85, 89, 93, 98, 100], the PLS-SEM results demonstrate that the SDGs Local Action Plan formulated by Green City Government significantly contributes to Green Governance City (H3,  $f^2 = 0.240$ ) and has a direct impact on Local SDGs Performance (H4,  $f^2 = 0.720$ ). The moderate effect size in H3 suggests that while the SDGs Local Action Plan plays a role in enhancing Green Governance City, its influence is complemented by other governance-related factors such as institutional capacity, leadership commitment, and stakeholder collaboration. The stronger effect size in H4 indicates that the action plan has a substantial impact on Local SDGs Performance, emphasizing its role as a strategic driver for sustainability outcomes. These findings confirm that the SDGs Local Action Plan serves as a structured, data-driven, and long-term policy framework that enables city governments to integrate sustainability principles into governance, improve stakeholder coordination, and facilitate the implementation of green innovations. The substantial impact on Local SDGs Performance highlights the effectiveness of the action plan in optimizing local resources, increasing public participation, and accelerating the transition towards a low-carbon economy. Thus, the SDGs Local Action Plan emerges as a key catalyst for urban transformation, reinforcing the development of adaptive, inclusive, and resilient Green City models that align with global sustainability goals.

Furthermore, our findings reveal that Green Governance City has a significant impact on Local SDGs Performance ( $H5$ ,  $f^2 = 0.304$ ). The acceptance of  $H5$  reinforces previous research emphasizing the role of green governance in improving sustainability through technological innovation, stakeholder engagement, and resource optimization [89, 105-107]. The moderate effect size suggests that Green Governance City plays a meaningful yet complementary role in enhancing local SDG outcomes alongside other sustainability-driving factors. This finding confirms that systematic green governance efforts can accelerate the achievement of green cities and improve Local SDGs Performance by strengthening institutional policies, urban resilience, and ecological sustainability. One of the key mechanisms driving this relationship is the strict management of green open spaces (RTH), which contributes to carbon sequestration, mitigation of urban heat islands, and improved air quality. These environmental benefits translate into better public health indicators, enhanced work environment satisfaction, and overall community well-being. Additionally, synergy among local governments, community organizations, and the private sector in green area management facilitates the implementation of sustainable development strategies. This collaborative governance model enhances citizen participation in local SDG actions, fostering bottom-up, co-creation policies that are more effective for long-term sustainability. From an economic perspective, transparent and accountable budget allocation strengthens policy effectiveness while promoting sustainable economic growth. Incentives for green innovation and technology accelerate the transition toward smart cities, improving resource efficiency and creating green jobs. Moreover, the integration of information and communication technology (ICT) in public services enhances bureaucratic efficiency and accessibility, reinforcing the global competitiveness of green cities. Thus, these findings highlight that Green Governance City serves as a critical enabler in achieving local SDG performance, emphasizing the importance of policy-driven sustainability, cross-sector collaboration, and technological advancements in urban development.

## 5.2 Implication

The theoretical implications of this study highlight the understanding of the role of GDC not only in improving urban environmental performance but also as a key factor in shaping more adaptive and innovative green governance. These findings support the theory of dynamic capabilities in the context of sustainability, suggesting that policy flexibility and responsiveness to environmental change are crucial elements for the success of green governance. This study also introduces a new perspective that green governance is not only the result of good regulations but also influenced by the readiness of organizations to adopt green innovations and apply them in real action. Thus, this research contributes to the literature on the relationship between governance, sustainability, and organizational capabilities in the urban context.

In addition, this study emphasizes that effective action planning of the SDGs Local Action Plan acts as a link between Green City policy strategies and local sustainability achievements. This contributes to the development of a governance model that emphasizes the importance of the SDGs as a catalyst for sustainable policies. Further, these findings reinforce the concept that successful green cities not only depend on strict environmental policies but also require

data-driven and technology-driven approaches in policy implementation. These implications add insight to the Smart & Green Cities literature, highlighting how the interplay between governance, technology, and sustainability can create a more efficient and inclusive model of urban development.

The results of this study provide practical insights for urban governments and stakeholders in optimizing green governance through strengthening GDC and implementing the SDGs Local Action Plan. This study confirms that cities that want to accelerate the transition to a Green City need to build dynamic green capabilities to be more adaptive to environmental challenges and able to respond to changes with sustainable innovation. Local governments can adopt an approach based on policy flexibility and responsiveness in designing regulations that are more proactive toward sustainability. Strengthening GDC in city governance will encourage more data-driven decision-making and increase the effectiveness of cross-sector coordination. Cities that successfully develop dynamic green capabilities will have an advantage in adopting green technologies, accelerating the implementation of innovative solutions, and strengthening ecological competitiveness.

In addition, the role of the SDGs Local Action Plan as a strategic instrument further emphasizes the urgency of preparing a structured and data-based action plan to support the achievement of the SDGs at the local level. Local governments need to ensure that the action plan that is prepared reflects the specific needs of the city and pays attention to the balance between social, economic, and environmental aspects in the community. The preparation of a participatory SDGs Local Action Plan will strengthen synergy between the government, the community, and the private sector in implementing sustainable policies. Effective green governance depends not only on policy but also on the active involvement of stakeholders. Therefore, city governments need to encourage closer collaboration with the private sector and local communities in creating green initiatives. Incentives for environmental technology innovation, the development of green jobs, and increasing sustainability literacy for the community are strategic steps that can accelerate the implementation of Green Governance City. The success of green governance is also closely related to efficiency in the management of city resources. Strengthening regulations related to green open spaces, sustainable waste management, and reducing carbon emissions are important aspects of improving the quality of the urban environment. The integration of information technology and paperless administration in city governance can increase transparency, accountability, and effectiveness of policy implementation.

The involvement of academics is also crucial in supporting the success of this sustainability policy. Collaboration between universities and local governments needs to be strengthened to develop innovative solutions that can be directly applied to green governance policies. In addition, academics take a role in increasing the green capacity of local governments through training and workshops related to sustainability policies and the use of technology. The involvement of academics in policy forums and the development of environmental strategies will strengthen the implementation of Green Governance City more effectively and sustainably.

Overall, this study emphasizes that the transformation towards a Green City requires a holistic approach that combines dynamic green capabilities, effective planning of SDG actions, and inclusive and collaborative governance.

Urban governments that are able to adopt strategies are expected to be better prepared to face sustainability challenges and create green cities that are more resilient, adaptive, and environmentally friendly.

## 6. CONCLUSIONS

This research reveals that GDC has a crucial role in strengthening Green Governance City and improving Local SDG performance. The results of the analysis show that GDC contributes significantly to green governance and the achievement of urban sustainability. In addition, the SDGs Local Action Plan has also proven to have a positive impact on green governance and the achievement of sustainable development targets at the local level. In addition, the positive relationship between Green Governance in City and Local SDG performance shows that effective green governance can improve community welfare and urban ecological competitiveness. This study provides insights for local governments to strengthen green capabilities and develop sustainability policies that are adaptive, inclusive, and based on multi-stakeholder collaboration to accelerate the transformation towards a more adaptive, inclusive, and sustainable Green City.

This study has some limitations that could be an opportunity for future research. First, this study only focuses on the relationship between GDC, SDGs Local Action Plan, Green Governance City, and Local SDGs Performance, without considering external factors such as national regulations and macroeconomic conditions. Second, the methodology used is based on PLS-SEM, which, although suitable for exploring latent variable relationships, does not delve into the causality mechanism between variables. For future studies, it is advisable to consider external factors such as national and global policies related to sustainability. In addition, a mixed-method approach can be used to obtain deeper qualitative insights. The next study can also explore the longitudinal aspect to understand the dynamics of long-term changes in the implementation of Green Governance City and the influence of innovative technology in accelerating the achievement of the SDGs at the local level. This study has also not conducted a multi-group analysis (PLS-SEM) to compare responses from different administrative levels within the government. Future research could explore this aspect to gain deeper insights into how governance dynamics vary across hierarchical levels, potentially revealing differentiated policy impacts and implementation challenges.

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