



Assessment of the Sustainability of Accra Metropolitan Area, Ghana

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Abstract

Cities have become integral in the quest to achieving universal sustainable development. For example, the United Nations in 2015 as part of the 17 Sustainable Development Goals called for cities and human settlements to be inclusive, safe, resilient and sustainable (Goal 11). This was in line with the 2012 National Urban Policy of Ghana which seeks to promote a sustainable, spatially integrated and orderly development of urban settlements with adequate housing, infrastructure and services, efficient institutions, and a sound living and working environment for all people to support the rapid socioeconomic development of Ghana. Six years into the implementation of the National Urban Policy by the government, what is the sustainability status of the Ghanaian city? The aim of this study was to comprehensively evaluate the sustainability status of Accra Metropolitan Area, the capital city of Ghana. The study adopted a set of city sustainability indicators that revealed the weak and strong points of Accra metropolis. Forty-one Accra Sustainability Indicators were defined and classified into Economic, Environment, Social and Institutional (local governance) dimensions. The evaluation was for a period of 4 years, (2012 to 2015) during which the 2012 Urban Policy and its action plan were being implemented. Questionnaires were developed based on the indicators and administered to stakeholders. The quantitative data collected was analyzed using Statistical Package for Social Sciences (SPSS) and Microsoft Excel. The results showed Accra's economic dimension approaching sustainability while environmental and institutional dimensions performed poorly. The social dimension, though performed below average, rose marginally over the period. Overall sustainability index of Accra was below average and showed a progression towards sustainability over the last 4 years, rising from 0.48 in 2012 to 0.51 in 2015. The findings of this study are helpful to local authorities for sustainable city planning and management.

Keywords: Sustainable city; Sustainable development indicators; City sustainability assessment; Accra

Introduction

With 54 % urbanization, Ghana has witnessed an unprecedented urban growth in the past 20 years [1]. This rapid urbanization is associated with: 5.7 annual contributions to Gross Domestic Product from 1984 to 2013; structural transformation; and poverty reduction with Accra alone experiencing 20% drop in its poverty index from 1991 to 2012 [2]. However, Ghana's urban areas especially Accra has been characterized with problems such as land use disorder, pollution, stressed urban services such as water and electricity, growth of slums, poor transport infrastructure and traffic management amongst other negative aspects [3]. In an attempt to find solution to these problems, the government of Ghana has implemented a number of policies including the recent 2012 National Urban Policy and the Accra Millennium City Project with the aim of promoting more sustainable cities. After years of implementing urban policies and projects, and five years into the 2012 National Urban Policy and its action plan, this study evaluated the city's progress towards achieving sustain-able development.

A sustained development is the coordination of socio-economic and environmental management goals by system of government (institutions) to bring long term growth and progress characterized by efficient use of resources, clean environment, healthy people, justice and equal opportunities for all. Therefore, a sustainable city is an urban area that satisfies the needs (in terms of infrastructure, education, safety, health and medical care, housing, utilities, greenery and good governance) of both current and future generations. It is capable of addressing environmental challenges associated with urban growth, middle-income status and population increase [4]. Due to the importance of cities in human development, the United Nations (UN), as part of the 2030 Agenda for Sustainable Development (Goal 11), called on governments to make cities and human settlements inclusive, safe, resilient

and sustainable [5]. This goal aims to address issues regarding the provision of houses and essential needs, transport, participatory human settlement development, protection of cultural and natural heritages, disaster reduction and decreasing the per capita environmental impact of a city [5]. Development of sustainable cities depends on governments' ability to significantly decouple economic growth from inefficient use of natural resource and environmental degradation.

Sustainability assessment is essential to implementing and evaluating the sustainable development agenda. The two most recognized methods of assessing the sustainability of an industry, state or a nation are monetary aggregation methods and the use of physical indicators [6]. The monetary aggregation method, normally adopted by economists, includes the use of monetary units and economic methods, such as Cost Benefit Analysis, Green Domestic Product, and Resource Accounting. This method however has major limitations including the difficulty in placing monetary values on natural capital and intangible resources, such as air [7]. As a result the use of physical indicators have become a widely-used approach to assessing sustainability, especially since 1992, when the UN approved such indicators as key aspects of sustainable development. Examples of city sustainability assessments, which used this approach, include the Sustainability Index for Taipei in Taiwan where 51 indicators were developed by the researchers and statistical data from 1994 to 2004 was collected and analyzed using standard deviation [8]. Xiao et al. [9] also developed 18 relevant indicators to assess 112 Chinese cities over the period of 2004 to 2008 using statistical analysis. As an expansion to the work of Xiao et al., the China Urban Sustainability Index 2013 evaluated 185 cities for the period of 7 years from 2005 to 2011 using quantitative analysis to summarize the city's growth strategies [10].

The use of indicators can provide a good measure of a city's sustainable development [11]. In sustainability evaluation, indicators assess current sustainability conditions and trends, and anticipate future conditions. They are also useful tools for communicating performance, problem identification, urban planning, monitoring goals and objectives, and for important decision-making [11-12]. There are two main processes of developing indicators for sustainability assessment. One of such is the Driving Force State Response (DPSIR) approach. The DPSIR provides a causal loop for assessing the relationship between environment and society [13]. The framework explains that human activities and natural conditions put pressure on the environment. This leads to a change in the environmental condition. As a consequence, human health, ecosystems and economic resources are negatively impacted. This invariably calls for responses from institutions. Societal responses feed into all other elements to close the loop. This framework helps in assessing the causes and effects of environmental challenges.

Another credible and widely used means of developing good indicators for sustainability assessment is based on characterization. As expressed in previous works [14-16], sustain-

ability indicators must possess characteristics including comprehensiveness, relevance, data availability, national in scope, simplicity and conceptually sound among others. Some known sustainable development indices based on characterization include: United Nations Council for Sustainable Development Indicators [14]; Sustainable Cities Index 2015 [15] and Local Sustainable Development Indices [16]. This second widely used approach to indicator selection has been adopted in this research to evaluate the strength and weaknesses of Accra's sustainability. This approach is adopted because it is able to define simple, relevant and comprehensive indicators that are useful for local decision making, monitoring and evaluation.

1) Sustainable development history of Accra Metropolitan Area

Accra (Figure 1), the capital of the Republic of Ghana and the Greater Accra Region, is geographically located on longitude 05° 35' and latitude 00° 06' and shares boundaries with La-Dadekotopon Municipality to the east, the Gulf of Guinea to the south, Ga South and Central Municipalities to the west, and Ga West and La-Nkwata-nang Municipalities to the north [17].



Figure 1 Map of Accra Metropolis (Google Map).

With a total land area of 139.674 km² [18], and the 6th in West Africa [19]. It has a population of 2,277,000 in 2015 and is expected to

grow to 2,870,000 by 2025 [20]. Accra, a major contributor to the economic growth of Ghana, contributes about one-third of Ghana's total manufacturing output and 10 % of national Gross Domestic Product [21]. It is noted for major economic, institutional and social activities, such as manufacturing, marketing, banking and finance, entertainment, learning institutions, transport and governance.

Major challenges (Figure 2) of Accra include the destruction of wetlands, inadequate supply of urban service (including water and electricity), poor management of waste and increasing housing deficits which have resulted in the development of over 29 squats and slums [17]. To address these challenges and attain sustainability, the Accra Metropolitan Assembly (AMA) over the years implemented policies such as the *Ghana Shared Growth and Development Agenda* (I and II from 2010-2013 and 2014-2017 respectively) which had various policy directives aimed at promoting sustainable cities in Ghana. From 2010 to 2015, the AMA in partnership with the Earth Institute and

Columbia University implemented the *Millennium City Initiative* which aimed at addressing most pressing challenges of the city such as uncontrolled in-migration and slums; flooding, poor provision of water and sanitation facilities; traffic congestion and pollution among others in order to achieve the Millennium Development Goals [22]. The 2012 *National Urban Policy* of the Government of Ghana was implemented in urban areas including Accra Metropolis. The policy seeks to promote a sustainable, spatially integrated and orderly development of urban settlements with adequate housing, infrastructure and services, and efficient institutions [3]. From 2008 to 2015, the AMA implemented the *Participatory Slum Upgrading Project* which strengthened the capacity of institutions and key stakeholders in settlement and slum improvement through the use of good governance and management approaches. These policies and programmes projected the city economically and socially and in terms of its governance.



Figure 2 Major challenges facing Accra including waste, pollution, traffic congestion and slum (Authors' fieldwork, 2017).

Materials and methods

1) Selection of sustainable development indicators

Based on the characterization procedure [13-16], this study firstly selected a set of 51 Accra Sustainability Indicators from among the 2012 National Urban Policy indicators [3], the United Nations Sustainable Development Goal 11 indicators [5], and the Ghana Shared Growth and Development Agenda II indicators [23]. These 51 indicators were subjected to scrutiny by experts in the following government departments and agencies based on five characteristics namely data availability, simplicity, usefulness for local decision making, relevance to national policy and consideration of very basic needs of the people.

- Accra Metropolitan Assembly
- Environmental Protection Agency
- Accra Metropolitan Education Directorate
- Accra Metro Health Services Directorate
- Ghana Statistical Service
- Environmental Health Department of Accra
- Metropolitan Agriculture Development Unit

As a result 41 Accra Sustainability Indicators (ASI) were finally approved by the stakeholders as relevant indicators for assessing the sustainability of the city. For a comprehensive sustainability assessment, the indicators quantified all economic, social, environmental and institutional aspects of the city. The economic component described performance of the city in terms of access to energy and transport, level of unemployment, urban poverty and income inequality. The social component described issues including housing, health, education, supply of utilities and security. Environmental sustainability concerned issues of pollution, sanitation, and land uses. The environmental indicators also include the integrated sustainable waste management (ISWM) indicators of waste collection coverage, disposal and management [24-25]. Finally, this study

included institutional dimension which considered local government issues such as gender equality in local governance, financing disaster risk reduction, efficient revenue mobilization and financial management.

2) Data collection

Quantitative data (X_i) on the ASI was collected for the period of four years (2012-2015) from the Accra Metropolitan Administration, the Environmental Protection Agency, Accra Metropolitan Education Directorate, Accra Metro Health Services Directorate and Ghana Statistical Service. Other sources included the Environmental Health Department of Accra, Metropolitan Agriculture Development Unit and government and international reports and publications on the ASI.

3) Data analyses and interpretation

3.1) Standardization and normalization of indicator values

Based on Singh et al., Lee et al., Xiao et al. and Li et al. [6, 8-10], this study used SPSS and Microsoft Excel to standardize and normalize indicator values as shown in the following steps and formula.

a) In order to normalize all indicators to the same units and scale, standardized values were calculated using the standard deviation formula as shown in Eq. 1.

$$\text{Standard value } Z = (X_i - \mu) / \sigma \quad (\text{Eq. 1})$$

Where Z = standardized value, X_i = Indicator value (quantitative data collected on the ASI through the questionnaire), μ = mean value and σ = standard deviation.

b) The next step was to normalize the standardized indicator values such that the values fell within 0 to 1 in order to facilitate the weighting of the indicators. The normalized

standardized value as shown in Eq. 2 is defined as:

$$Y = (Z_i - a) / (e - a) \quad (\text{Eq. 2})$$

Where Z_i lies between a to e , Z_i = standard score, a = minimum value, e = maximum value and Y ranges from 0 and 1.

c) Reverse indicators, such as incidence of crime were further standardized using the formula $(1-Y)$ so that all values nearer or equal to 1 are those approaching sustainability, while those nearer zero (0) means unsustainable development.

3.2) Weighting and calculating aggregate and overall scores

In this study, equal weight was assigned to each indicator based on the premise that they all possess equal significance to the sustainability of the city. Aggregate scores for each sustainability dimension, defined as Dimension Sustainability Score, were calculated using Eq. 3.

$$\sum_{i=1}^n (Y_i \times W_i) / (\sum_{i=1}^n W_i) \quad (\text{Eq. 3})$$

Where W = weighting of each indicator,

Y = normalized value of each indicator, n = number of indicator and i = year of assessment.

Finally, the overall Accra Sustainability Index was calculated by summing the sustainability of each dimension score in each year. Again, equal weight (1/4) was assigned to each dimension of Economic (ES), Social (SS), Environment (EnS) and Institutional (IS) as shown in Eq. 4.

3.3) Result interpretation

This study adopted the scaling of indices [6] from the range of 0 to 1. According to this scale, results nearer to zero means unsustainable while results closer to 1 means sustainable development. The study adopted the sustainability index scale in Table 1 to describe qualitatively the results of the analysis.

Table 1 Sustainability index scale

| Scale | Level of performance |
|------------|-------------------------|
| 0 - 0.49 | Poor |
| 0.5 - 0.59 | Below average |
| 0.6 - 0.69 | Average |
| 0.7 - 0.79 | Good |
| 0.8 - 0.89 | Very good |
| 0.9 - 1.0 | Excellent (sustainable) |

$$\text{Accra Sustainability Index} = \frac{\sum_{i=1}^n (ES \times w) + (SS \times W) + (EnS \times W) + (IS \times W)}{\sum W} \quad (\text{Eq. 4})$$

Results and discussion

1) Accra sustainability indicators

Table 2 is the set of the 41 ASI classified under economic, environment, social and institutional (sustainable local governance) criteria.

2) Economic sustainability performance

The economic dimension is the greatest contributor to the city's sustainability performance (Figure 3) with very good indices ranging from 0.84 in 2012 to 0.874 in 2015.

The indicators of this dimension maintained very good scores throughout the period of assessment. These achievements could be attributed to the numerous economic activities that exist in the formal and informal sectors and offers employment to over 90 % of the working population resulting in reduction of the city's Gini index from 0.5 in 2012 to 0.346 in 2015. A major achievement in the economic dimension is the access to electricity in the metropolis which recorded almost 100 % throughout the period. This study concentrated

only on the access to electricity by households without looking at power availability all year round due to lack of adequate data on per capita daily consumption of power in the city. The low indexed indicator in this dimension was access to public transport with indices ranging from 0.645 in 2012 to 0.698 in 2015 revealing the need for massive investment in the

transport sector. The economic sustainability performance affirmed Accra as a city with vibrant economic activities and a centre offering opportunities to both formal and informal sector workers, residents and other Ghanaians to enhance their economic and social welfare levels [26].

Table 2 Accra Sustainability Indicators (ASI)

| Economic (6) | Social (16) | Environment (13) | Institution (6) |
|--|---|--|--|
| 1. Incidence of poverty (living below poverty line of GH¢ 1,314 per annum) | 1. Percentage of urban population living in slums | 1. Concentration of PM10 in mg ms ⁻¹ at roadside | 1. Percentage of local government legislators who are women |
| 2. Incidence of extreme poverty (living below GH¢ 792.05 per annum) | 2. Percentage of population with access to potable water | 2. Concentration of PM10 in mg ms ⁻¹ in residential area | 2. Percentage of revenue generated from annual budget |
| 3. Index of income inequality (Gini Index) | 3. Infant mortality rate | 3. Concentration of PM10 in mg ms ⁻¹ in commercial area | 3. The rate of revenue to expenditure management |
| 4. Unemployment rate | 4. Under 5 mortality rate | 4. Concentration of PM10 in mg ms ⁻¹ in industrial area | 4. Percentage of total government expenditure allocated to waste management |
| 5. Percentage of population with access to energy | 5. Maternal mortality rate | 5. Percentage of population with access to approved toilet facilities | 5. Percentage of total budget expenditure allocated to disaster risk reduction |
| 6. Percentage of population with access to public transport | 6. Prevalence of HIV | 6. Total municipal waste collected daily | 6. Percentage of total expenditure on natural resource conservation |
| | 7. Prevalence of cholera | 7. Proportion of municipal waste recycled, reused and composed (plastic) | |
| | 8. Net school enrollment in kindergarten | 8. Total metal wastes recycled and reused | |
| | 9. Net school enrollment in primary | 9. Volume of waste water treated annually | |
| | 10. Net school enrollment in JHS | 10. Water efficiency | |
| | 11. Net school enrollment in senior high school | 11. Proportion of land under agriculture cultivation | |
| | 12. Proportion of people with disabilities in special education | 12. Proportion of land classified as built environment | |
| | 13. Adult literacy rate | 13. Proportion of land covered by vegetation | |
| | 14. Annual crime rate | | |
| | 15. Rate of domestic violence | | |
| | 16. Rate of child abuse | | |

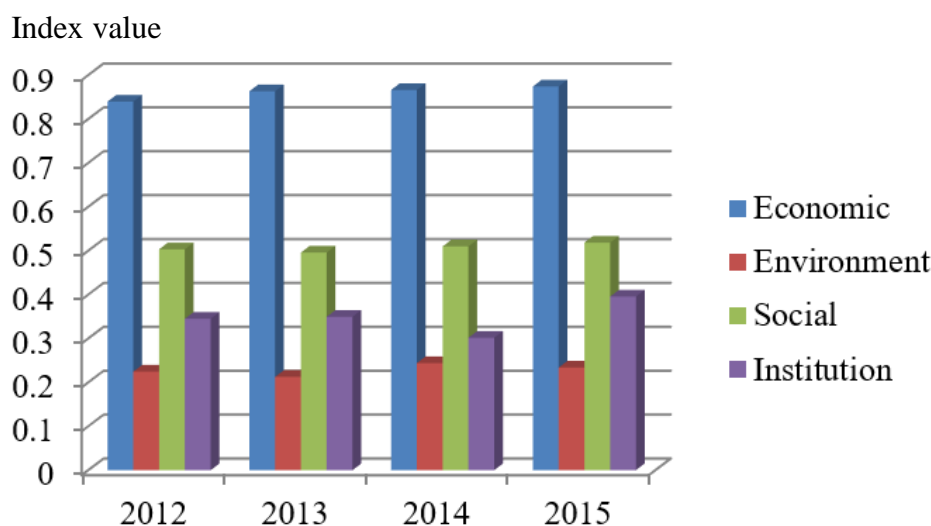


Figure 3 Sustainability performances by dimension.

3) Social sustainability performance

The social dimension of Accra showed below average sustainability performance. This is however the second strongest performing sustainability dimensions of the city. Its sustainability indices rose from 0.50 in 2012 to 0.52 in year 2015 (Figure 3). There was, however, a decrease in 2013. This was because the highest incidences of maternal death (338 per 100,000 live births) and populations living in slum conditions were recorded in 2013. However, government interventions, such as decongestion of the slums by the city authority [27-28] improved these measures in 2014 and 2015. The high indices in this category came mainly from health indicators, such as low cases of child mortality and decreased incidence of diseases including cholera and HIV/AIDS. For example, child mortality decreased from 25 per 1,000 live births in 2012 to 15 per 1,000 live births in 2014, meaning the city has achieved the UN SDG 3 target [29].

The low areas in the social dimension of Accra are seen in the difficulty of the AMA to significantly provide social services and infrastructure for the increasing population. The city still struggles with inadequate supply of quality piped water to the extent that some communities have access to pipe water only

once a week [30]. There is also annual backlog of over 300,000 housing units, resulting in the growth of over 29 squatter zones and slums [21]. Some educational indicators of the city also showed poor scores. Despite the existence of many public and private schools at all levels, coupled with the Free Compulsory Universal Basic Education (FCUBE) programme by the government, net school enrollment is low. The National Development Planning Commission [31] confirmed that the Accra Region as a whole recorded the lowest net enrollment in primary schooling in the country, even though it has the lowest poverty incidence.

4) Environmental sustainability performance

Accra's growing economic opportunities attract rural-to-urban migration from other parts of the country into the city's major slums, including Old Fadama and Nima [38] resulting in increased population and consumption. The increased demand for goods and services, such as housing, leads to encroachment on wetlands, as well as building on water ways, which sometimes lead to flooding (for example June 4, 2015). The high population's consumption and waste generation worsens the city's sanitation. This is evident in volume of solid wastes left uncollected daily in areas such as

Makola, Kantamanto and Agbogloboshie markets and in major slums. The environment is the weakest dimension of the city's sustainable development. The environmental sustainability of Accra (Figure 3) showed poor performance decreasing from 0.23 in 2012 to 0.21 in 2013. In 2014, as a result of implementation of government policies on decongestion, this dimension increased in 2014 to 0.25 but decreased again in 2015. The 2015 decrease may be attributed to the major flood that occurred in June 2015 that destroyed agricultural and vegetative lands. The overall poor performance of the environment dimension is also negatively affected by poor waste management, air pollution and inadequate access to approved toilet facilities [19, 32-33]. For example, the mean annual concentrations of particulate matter (PM10) recorded over the 4 years were higher than the standard Air Quality Index (AQI) of Ghana's Environmental Protection Agency [34], posing a serious health risk for people with lung diseases, children and the very old. The vegetative cover of the city continuously decreased from 0.00046 % in 2012 to 0.0003 % in 2015. These portions of total land were cleared to make way for built-up area which has increased from 64 % in 2012 to 72 % in 2015. Agricultural land also saw depreciation in proportion during the period from 0.068 % in 2012 to 0.0079 % in 2015. Other challenging environmental concerns include poor access to approved sanitation facilities which recorded as low as 30 % in 2012 but increased to 55 % in 2015. There was also low treatment, composting, recycling of waste.

5) Institutional sustainability performance

Accra's weak governance resulted in the poor institutional sustainability performance of the city. Figure 3 shows the institutional sustainability performance of the study area over the four years. The results showed that

Accra has a relatively effective revenue generation (for example generating 109.13 % in 2012) and efficient financial expenditure management. The weak indicators were shown in low number of women represented in the local government (only 10 % to 17.8 %). The 0 % budget allocation to natural resources conservation throughout the period of assessment is the weakest sustainability indicator of this dimension. Natural resource conservation is a critical aspect of the UN SDG as shown in SDGs 13, 14 and 15 which deal with climate change, conservation and sustainable use of oceans and marine resources as well as the protection and restoration of ecosystems [5]. Other low points include the city authority's low budget allocation for disaster risk reduction (0.30 % of total budget in 2012) in a city where flood and fire are common occurrences. Finally, the low budget allocation to waste management by the city (between 4.7 % in 2012 to 6.5 % in 2015) gives credence to the poor sanitation situation shown in the environmental dimension of this study. This explained why about 20 % solid waste was still left uncollected daily in the city. These weaknesses in the administration of Accra were also highlighted in Fobil et al. [35] and Oteng-Ababio et al. [36].

6) Overall sustainability performance

The composite of all four dimensions in each year of assessment produced the overall sustainability index of Accra (Table 3). This below average performance showed a slight progression to sustainability over the last four years from 0.478 in 2012 to 0.506 in 2015. The rise in 2015 is attributed to appreciation in the 2015 sustainability index of the economic, social and institutional dimensions. The previous years 2013 and 2014 recorded an average index of ~0.48 because of the performance of social and institutional dimensions which had their

lowest scores of 0.496 in 2013 and 0.301 in 2014 respectively. An average of the scores of the four dimensions made the overall index to increase slightly even though the environmental dimension decreased. However, this does not mean the city is sustainable since absolute sustainability (an index of 1) is only possible when all four dimensions produced excellent scores. A study conducted by Tamanini et al.

[37] produced a sustainability score of 44.5 % (0.45) for Ghana (Accra), which is closer to the 2014 results (0.49) of this study, and also confirmed this research's findings on the economy and the worrying environmental performance of Accra. It is expected that with a boost in the environmental and institutional dimensions, the city may attain high sustainability in the near future.

Table 3 Summary of Accra sustainability performance from 2012 to 2015

| Assessment year | Dimension sustainability score | | | | Overall index |
|--------------------|--------------------------------|--------|-------------|-------------------------------|---------------|
| | Economic | Social | Environment | Institutional (governance) | |
| 2012 | 0.840 | 0.503 | 0.225 | 0.345 | 0.478 |
| 2013 | 0.863 | 0.496 | 0.213 | 0.349 | 0.480 |
| 2014 | 0.866 | 0.510 | 0.244 | 0.302 | 0.481 |
| 2015 | 0.874 | 0.518 | 0.234 | 0.396 | 0.506 |

Conclusion

The study evaluated the performance of the 41 Accra sustainability indicators which were categorized under economic, environmental, social and institutional dimensions. Based on data analyzed, this study was able to reveal the strong and weak sustainability dimensions and indicators of the city. The analysis showed that environment and institutional dimensions were closer to un-sustainability while economic dimension draws closer to sustainability and social performed below average. The environment of Accra characterized by pollution, poor sanitation and waste management, destruction of vegetative and agricultural lands was the weakest dimension of the city's development. It was followed by the institutional (governance) dimension as the second weak point of the city. This is seen in the city administration's weakness in waste management, poor implementation of planning schemes, disaster risk reduction and protection of the natural environment.

For strong sustainability, the AMA needs to direct its fast-growing economy to a greener growth path by addressing the city's major challenges. This study recommends job creation for youth, provision of consistent electricity and development of more Bus Rapid Transit (BRT) routes to promote economic sustainability of Accra. Environmental sustainability should be improved through constant monitoring of pollutants by Ghana's Environmental Protection Agency and prosecute offenders who exceed the standard Air Quality Index (AQI). Vegetative areas which were destroyed by debris and wastes should be restored through tree planting and development of the city's parks and gardens. With regards sanitation, the AMA should encourage waste segregation at source in order to promote waste recycle and reuse. The government should also discourage the use of plastic waste. Social sustainability can be achieved through the provision of uninterrupted social services especially water and affordable housing for residents. The Ghana Police Service should increase its com-

munity policing in order to reduce crime to its barest minimum. Accra's governance can be improved if Mayors are elected by the residents as is the case in many sustainable cities such as Frankfurt. This study also recommends inclusion of more women to ensure gender balance in the Local Assembly. There is the need for central government to give full financial autonomy to the local government to implement their sustainable development policies and programmes. Finally, the AMA should allocate more resources to very sensitive areas of the city especially waste management, disaster management and natural resource conservation.

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