Sustainable Cities Improvement by Applying Novel Urban Footprint in Different Cities

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Abstract: **The world's attention is now moving towards raising the environmental development to limit the environmental deterioration of the Earth. Since cities are responsible for more than 75% of the carbon emissions, the research focuses on studying the methodology of assessing the environmental impacts of cities on the planet by measuring the urban footprint of cities. The urban footprint is considered an important indication to assess the man's activities, practices and outputs in those cities. It also helps to understand the relationship between human activities and natural resources in the environment. This is through studying and analyzing several different cities regarding ideologies and urban characteristics. In order to get rid of environmental deterioration. According to what is stated above, the research proposal is based on finding out methods or criteria that should be put in consideration while cities planning or when tending to sustainability of cities such as: attention to the urban fabric, the urban patterns and uses, roads networks planning, residential density, construction ratio, the followed lifestyle in the city and handling of consumption outputs either gases or wastes. The previously mentioned part includes elements that must be put in consideration while planning the sustainable cities and there is no doubt that they are the most important factors influencing the urban footprint value of cities someway and thus their sustainability.**

Keywords: ***Footprint; Urban; Ecological; Sustainability; Environmental; Sustainable and Cities.***

I. INTRODUCTION

Since the 1992 United Nations Conference on Environment and Development, the Earth Summit in Rio de Janeiro, Brazil, the world has identified a new path to human welfare which is the sustainable development. The sustainable development is defined as " Development that meets the needs of the present without compromising the ability of future generations to meet their own needs". [1]

The sustainable development of society involves the improvement of the quality of life for all, both in the present and in the future, through using the Earth's resources as one of the basic principles of suitability, putting in consideration the future generations, securing the adequate resources to meet their needs and avoiding the environmental problems that cannot be solved.[2]

Cities play a vital role in the socio-economic development of countries. Urban efficiency allows sustainable urban settlements and strong economies to improve infrastructure, education, health, living conditions and poverty alleviation. One of the cities' biggest problems is environmental deterioration and inequality among communities that can be solved by correct planning and management.[3]

Environmental cities aim at alleviating poverty, improving climate conditions, improving waste collection efficiency, strengthening the capacity of local government and administration to establish a contemporary city catering to the needs of the population and providing a suitable life for them. To achieve this, the elements of sustainable cities must be developed which represent the following elements based on the previous studies in **Figure 1**. [3]

Cities are the container that embraces all human activities in different fields practiced by man, but they may be considered as one of the greatest human achievements on this planet. There is no doubt that they are the largest consumer of environmental resources on this planet. Thus, it is necessary to develop policies, strategies and mechanisms to control the flow of environmental resources to and from these cities.

The calculations of Ecological Footprint were designed to represent human consumption of biological resources and generation of wastes in terms of appropriated ecosystem area, which could then be compared to the biosphere's productive capacity each year.[4]..[5]. As mentioned by Ress, Ecological Footprint analysis not only measures the sustainability gap,but it also provides insight into strategies for sustainable urban development. However, it is believed that the urban footprint is more accurate to focus on shortcomings in the implementation of cities sustainabilitystrategies. So, the urban footprint is the alarm that signals the depletion of resources and the need to review theconsumption ofenvironmental resources in cities.

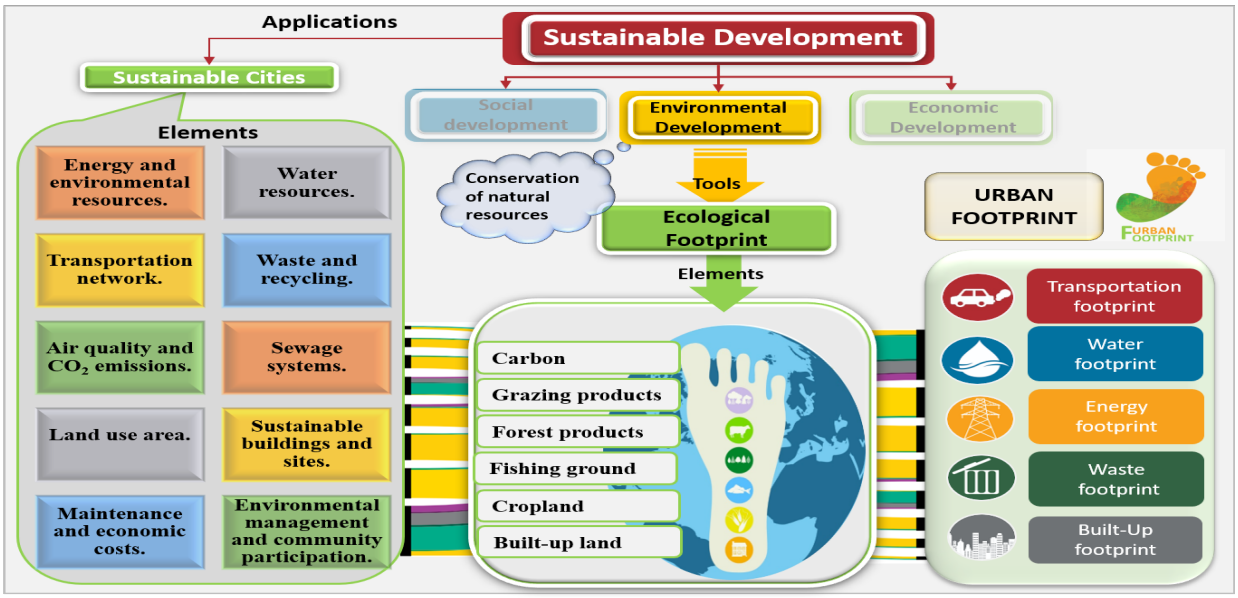


Fig 1. Relationship between Sustainable cities elements, Ecological Footprint elements and Urban Footprint

The contributions of this manuscript can be summarized as follows:

- Identify the affecting Urban sectors on Urban Footprint of each cities.
- Comparison between the Urban Footprint of the urbanization sectors of the studied cities.
- Access to factors affecting the urban footprint in terms of urban cities.
- Access to urban methodologies or standards to increase urban sustainability and reduce its footprint through sustainable urban planning.

The rest of this paper will be discussed: In Sec.2, Urban footprint (concept and its factors affecting in it) is discussed. In Sec.3, Case study for different cities is presented. In Sec.4, Discuss the analysis of the results of comparison between the cities. finally, Conclusions are made in Sec.5.

II. URBAN FOOTPRINT (CONCEPT & CALCULATIONS)

Cities now constitute a great proportion of the demand on natural resources both as a source of services and as a repository for waste. Some surveys suggest that urban areas represent about from 57 % to 80% of carbon emissions. One means of assessing the impact of human activity on the use of natural resources is the concept of the ecological footprint.[6].

The urban footprint is one of the expressions of the amount of environmental impact by calculating the effect ofman dealing with natural capital from the consumption of resources and the absorption of waste within a certain area represented by the city area. Different cities' Ecological Footprint Values are largely driven by socio-economic factors, such as available income, infrastructure, and cultural habits, Therefore, the factors affecting the urban footprint can be limited to the following points:

- Form of urban pattern: that the planning of cities and urban pattern has a significant impact on the size of the urban footprint in the city where the compact pattern reduces the value of the urban footprint on the extended pattern, which reduces the infrastructure services and reduce the areas of paths and roads.[7]
- Living style & type of housing: Walker (1995) has shown that the increased density associated with high-rise apartments, compared to single-family houses, reduces those components of the per capita ecological footprint associated with housing type and urban transportation by 40%. But People often move to cities because of greater economic opportunities. To the extent that the higher incomes associated with urban employment result in increased average personal consumption (net of any savings resulting from urban agglomeration economies), the urban ecological footprint may well expand beyond the base case.[8]
- Culture & environmental awareness: Sometimes, there are many human impacts on the environment related to consumption do not affect the characteristics of cities of the formation or style, but the effects are the result of areflection of values and behavior and community and individual activities and customs and traditions.
- Land use and distribution of services in the city: Style of distribution for services in the city affects the distribution of infrastructure networks, traffic distances and roads and thus affects the ecological

footprint of the city. Therefore, the use of mixed land reduces the value of the ecological footprint.

- Population density: The higher the population, the greater the pressure on facilities (infrastructure) as the rate of consumption in the city while at the same time the decline in the rate of population in the city than the normal rate is a waste of resources in the city, so must find a ratio between the size of the city and the population in them and in both cases affect the Increased ecological footprint.
- Environmental management & Recycling policy: environmental management strategies control the ability to reduce the value of the ecological footprint through the development of many obligations and safeguards and to guide existing technology in the service of the environment through transport technologies, policies, recycling of used materials and recycling of waste.

These elements have been reached based on what was studied in the previous literature reviews through the analysis of indicators of measuring sustainability and linking them to the idea of environmental footprint. These indicators have been transformed into computable data and thus provide a more accurate product of the sustainability of cities, based on what has been studied in Table 1. :

Table 1.
Urban Footprint elements (concept and equations)

Urban Footprint elements	Concept	Influencing factors	Equations
Transportation Footprint	refers to the land area required to sequester the carbon dioxide (CO_2) emitted from the burning of fuels by vehicles driving along highways (Chi, G. and Y. Zheng , 2013).	1.Urban form & vehicle miles traveled 2.Fuel types & pattern fuel consumptions 3.Car occupancy 4.Road space	Summation of: I. Built – up footprint (for transportation) = roadway area (ha) * Equivalence factor(gha/ha) II. Energy footprint for fuel consumption of vehicles = (Co_2 consumption for fuel (ton Co_2 /year) / conversion factor (Ton co_2/ha/year)) * Equivalence factor for forest land (gha/ha). III. GHG footprint for the manufacture and the maintenance of vehicles = 45% from Co_2 consumption for fuel Co_2 ton/year / conversion factor (Ton co_2/ha/year)) * Equivalence factor for forest land (gha/ha).
Water Footprint	The water footprint is a measure of humanity's appropriation of fresh water in volumes of water consumed and/or polluted.	1.Type of use (residential, commercial, agricultural, etc.). 2.Average per capita consumption per day This follows the lifestyle of the city or neighborhood level. 3.The method of handling gray water whether through recycling or waste water.	Water footprint (gha) = total consumption of water (Megaliters)x ecological footprint conversion (gha/Megaliters)
Energy Footprint	An energy footprint is a measure of land required to absorb the Co_2 emissions.	1.Amount of consumption 2.Energy forms used: They vary from city to city and from year to year, whether the form of energy is natural gas or oil.	The Energy footprint = The amount of consumption (GHW) * Emissions conversion factor (Kg of co_2 /GHW) *Equivalence factor (gha/ha) / conversion factor (Ton co_2/ha /year)
Waste Footprint	The waste footprint is the loss of embodied energy to be disposed of by: 1.Transfer of waste from homes to the landfill and 2.number of persons 3.energy used in the recycling of waste	Waste types or their source: such as household, commercial and industrial waste, construction waste or water waste, 1.The components of those wastes, there are biodegradable materials and need less energy for the disposal of them or materials 2.Method of treatment of waste	The Waste footprint = the amount of waste generated from the substance (kg- ton) * Co_2 emissions (Co_2 ton/year) *Equivalence factor (gha/ha) / conversion factor (Ton co_2/ha /year) And, Co_2 emissions for Waste equation: $E_{CO2} = MSW*\sum (WF_j * DM_j * CF_j * FCF_j * OF_j) * 44/12(t)$
Built-up Footprint	The built-up land Footprint represents bioproductive land that has been physically occupied by human activities.	The amount of land occupied by buildings and roads as well as the materials stored within the buildings.	$Built_{up} Land\ footprint = Built_{up} area(ha) * Equivalence\ factor\ (gha/ha)$

III. CASE STUDIES FOR DIFFERENT CITIES

Several cities were selected to apply the previous Urban Footprint equations. The choice was made since the availability of the required information and the possibility of expressing the largest part of the planet. The cities described in the following Table 2. Were therefore selected in Figure 2.:

Fig 2. Site study samples on the map.

Table 2.
Samples study

N. Sample	City	Country
I.	London city	England
II.	Berlin	Germany
III.	Singapore	Singapore

The analysis will be done through Evaluation results by Urban Footprint Models: The Urban Footprint of the study samples is computed based on the graphing equations of the previous chapter. The footprint of the five elements is calculated by the models in Figure 3.:

Fig 3. Model of the measurement Urban Footprint.

3.1 Case study (I) (London city):

London is the UK's largest city and its capital. It has also come to be recognized as a global center for financial and professional services, as well as a major tourist. Destination. The city has a population of 10.5 million and is the headquarters for more than one-half of the UK's largest companies

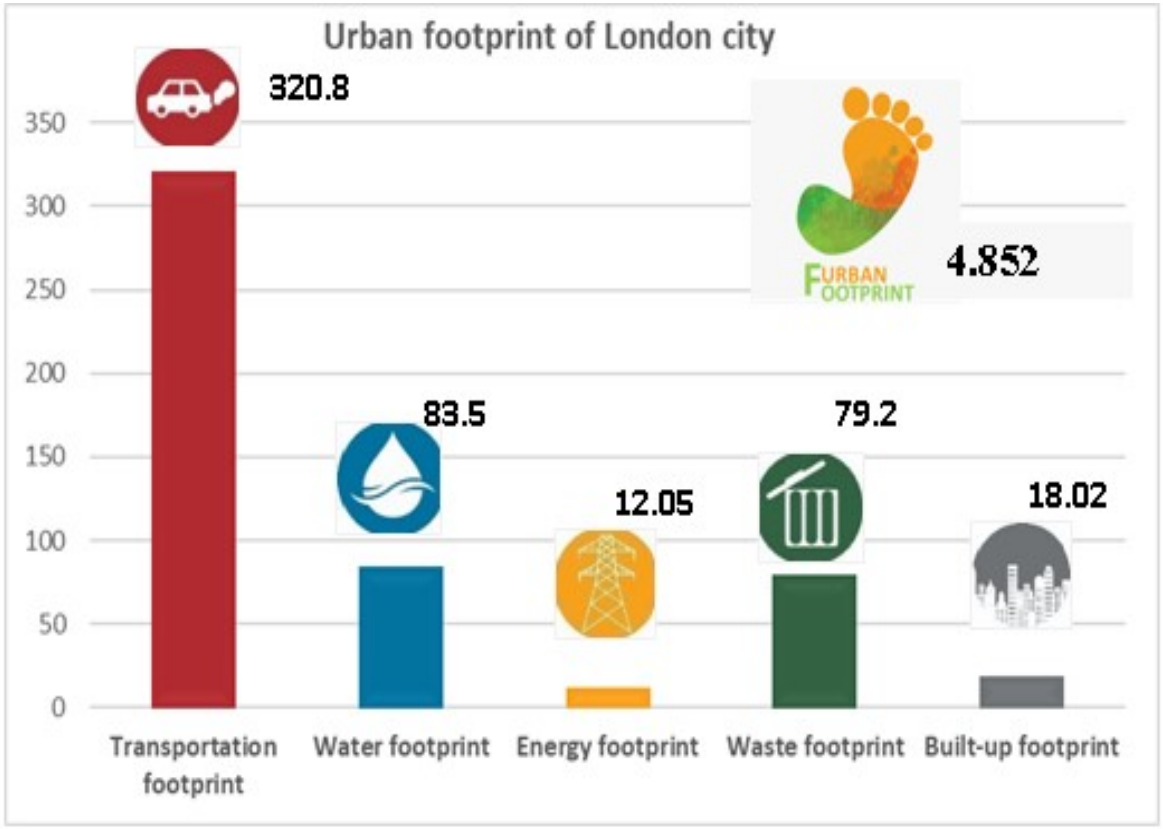
Evaluation results by Urban footprint model:

The results of the equations are based on the data shown in the **Table 3.** :

Table 3.
General indictors of London city.

Transportation built – up area	2.2542
Co_2 consumption from transportation	643.22
Maintenance value for transportation	289.45
Total water consumption (mega liters)	910.25
Co_2 consumption from energy	35.68
Co_2 consumption for waste	234.42
Built – up area	7.154

Based on the above, the value of Urban Footprint is the sum of its five components: total urban footprint for London = 513.622 gha, 4.852 gha/citizen



From the chart above, the largest contributor to the value of the environmental footprint of the city of London is the transport due to the large networks of traffic and the increase in the number of vehicles as explained in the previous points Then comes the signs of waste and water, so the total footprint is equal

Fig 5. Results of measuring urban footprint for London city.

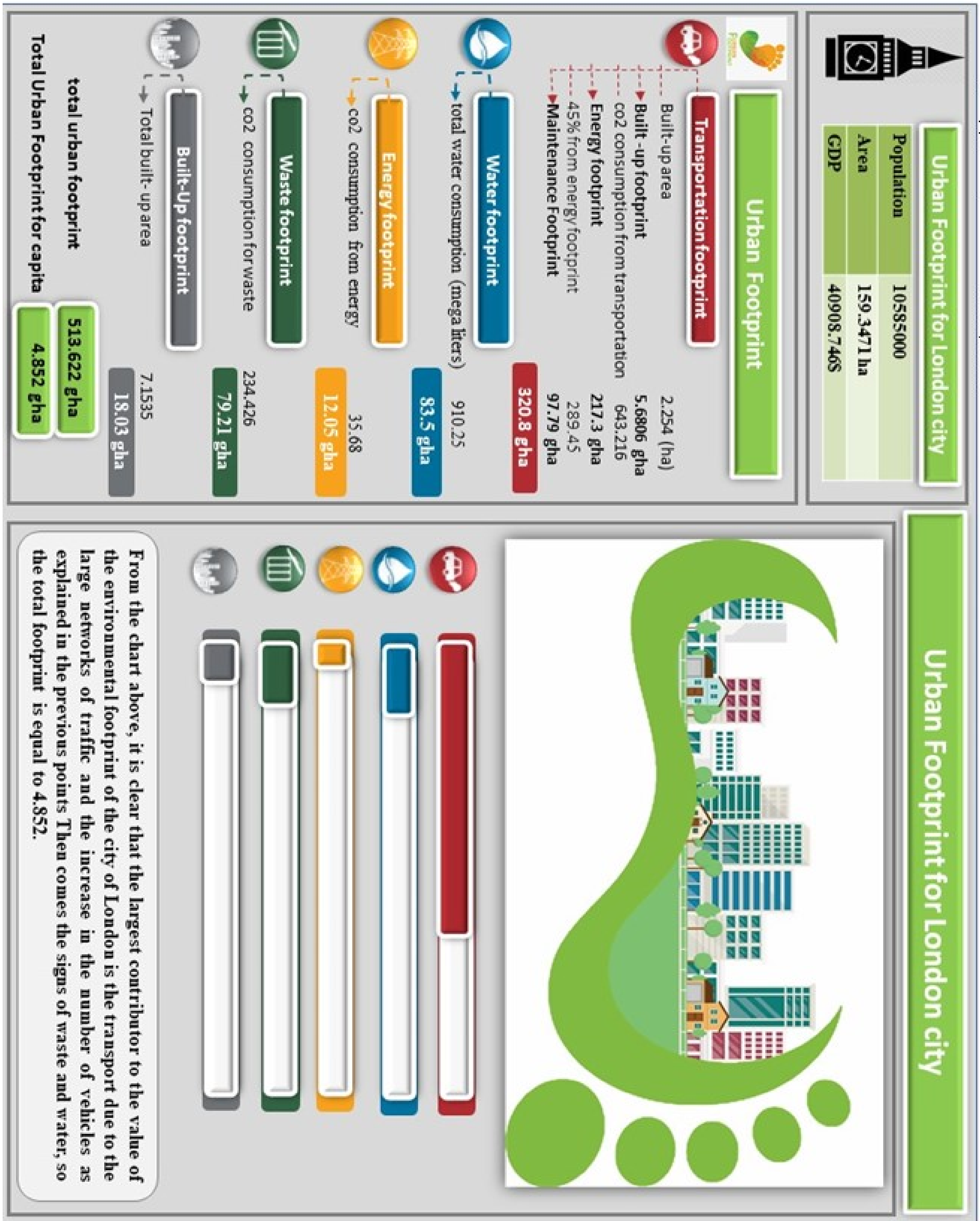


Fig 6. Model of Urban Footprint of London city

3.2 Case study (II) (Berlin):

Berlin is Germany's capital and the nation's most crowded city, with somewhere in the range of 4 million occupants inside its city limits. The city's economy is fundamentally founded on administrations, incorporating different media and creative industries, tourism, life sciences and pharmaceuticals and meetings among other activities.[9]

Fig 7.berlin land use. **Invalid source specified.**

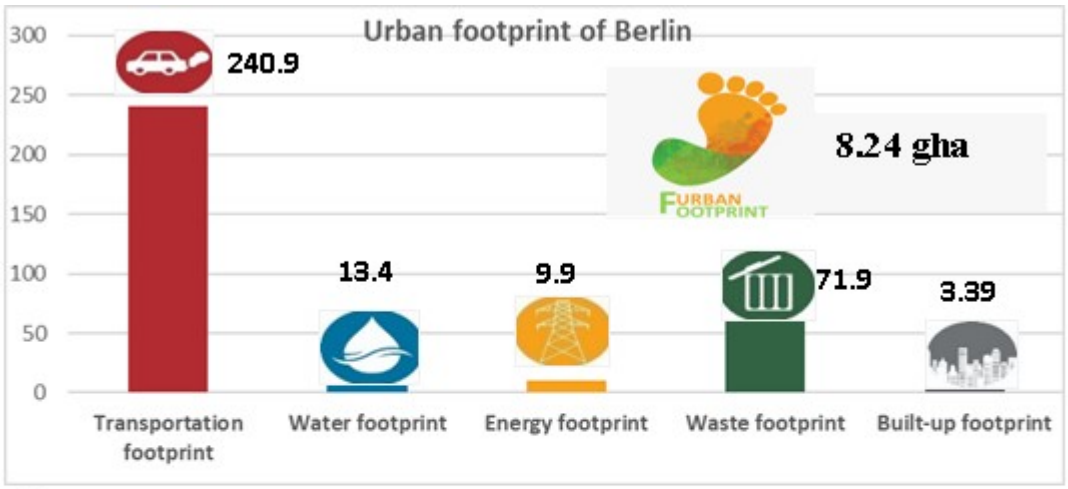
- *Evaluation results by Urban footprint model:*

The results of the equations are based on the data shown in the **Table 4.:**

Table 4.
General indictors of Berlin

Transportation built – up area	1.328
co_2 consumption from transportation	484.9
maintenance value for transportation	218.21
total water consumption (mega liters)	146.2
co_2 consumption from energy	29.5
co_2 consumption for waste	213.1
built – up area	1.35

Based on the above, the value of Urban Footprint is the sum of its five components: total urban footprint for Berlin = 339.67 gha, 8.24 gha/citizen.



From the chart above, the largest contributor to the value of the ecological footprint of the city of Berlin is the transport due to the large networks of traffic and the increase in the number of vehicles as explained in the previous points. Then, the value of waste comes, so, the total footprint is equal to 8.24. Although the city's total footprint is the lowest in the sample of the studied cities, Berlin is one of the most sustainable and sustainable cities, but the value of its footprint is high because of its low population.

Fig 8. Results of measuring urban footprint for Berlin

3.3 Case study (III) (Singapore):

Singapore is a prosperous city, state on the southern tip of Malaysia, with a populace of around 5 million individuals creating a GDP for each individual of 36,500 $, US Services represent around 66% of the city's monetary yield, with industry with industry making up just over a quarter.

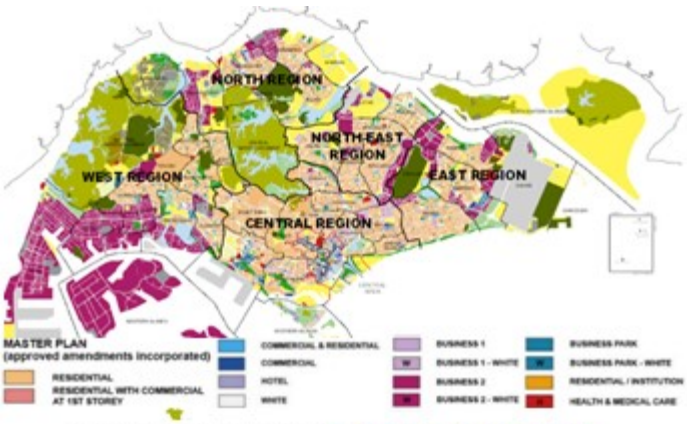


Fig 9. Singapore land use**Invalid source specified.**

- *Evaluation results by Urban footprint model*

The results of the equations are based on the data shown in the **Table 5.**:

Table 5.
General indictors of Singapore

Transportation built – up area	**1.432**
co_2 consumption from transportation	**718.961**
maintenance value for transportation	**323.53**
total water consumption (mega liters)	**213.379**
co_2 consumption from energy	**51.32**
co_2 consumption for waste	**177.995**
built – up area	**5.18**

Based on the above, the value of Urban Footprint is the sum of its five components: total urban footprint for Singapore = 465.952 gha, 7.85 gha/citizen.

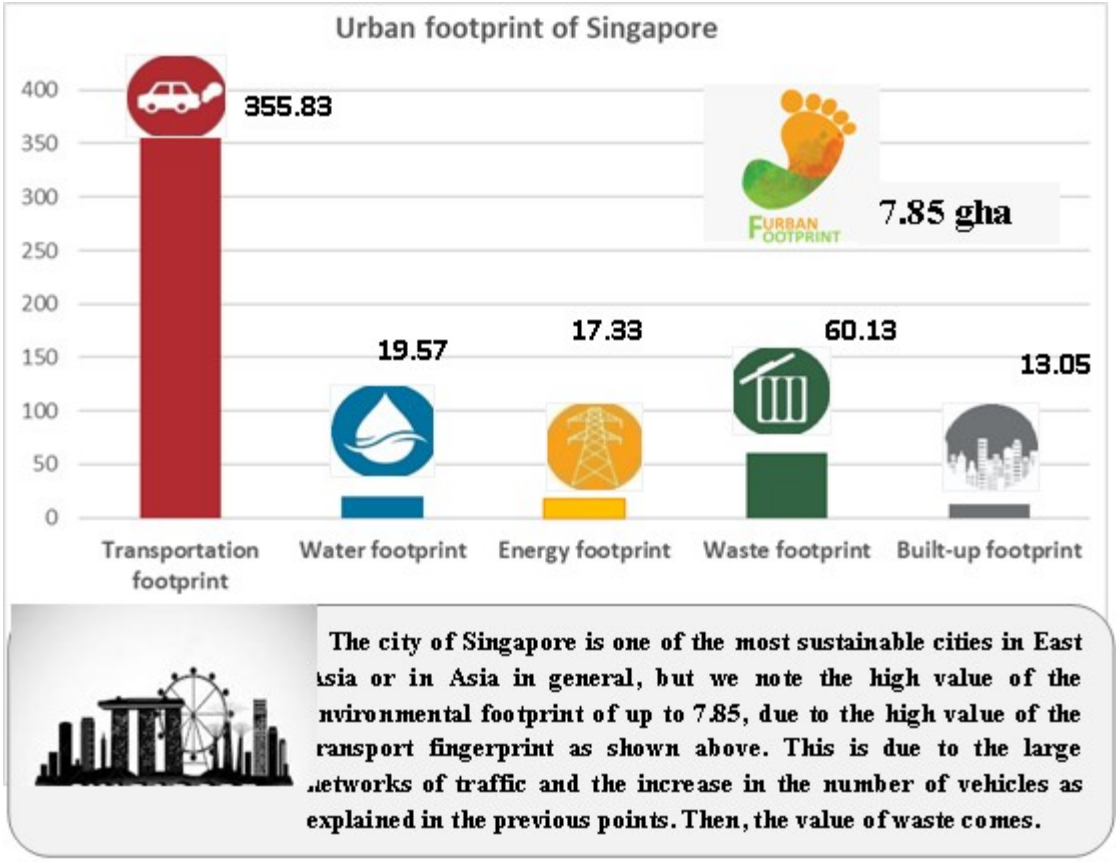


Fig 10. Results of measuring urban footprint for Singapore

IV. RESULTS AND DISCUSSION

The following **Table 6.**Shows a comparison between the two fingerprint elements of the study samples:

Table 6.
Comparison between Results of Urban footprint cities

Urban footprint elements	London	berlin	Singapore
Transportation footprint	320.8	240.9	355.84
Water footprint	83.52	13.42	19.58
Energy footprint	12.06	9.97	17.33
Waste footprint	79.23	71.9	60.13
Built-up footprint	18.03	3.4	13.1
total urban footprint	513.6	339.6	465.95
total urban footprint for capita	4.852	8.24	7.85

The values of the urban footprint of the studied cities indicate that Berlin is the highest city while London is the lowest, but in fact these values do not indicate the sustainability of the city but indicate the sustainability or impact of each individual's ecological footprint in the city.

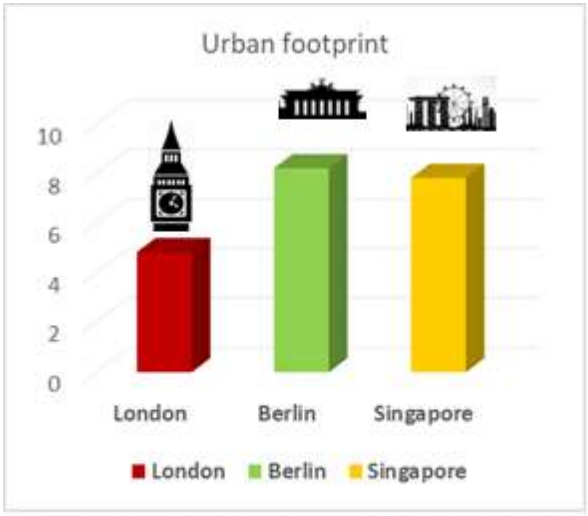
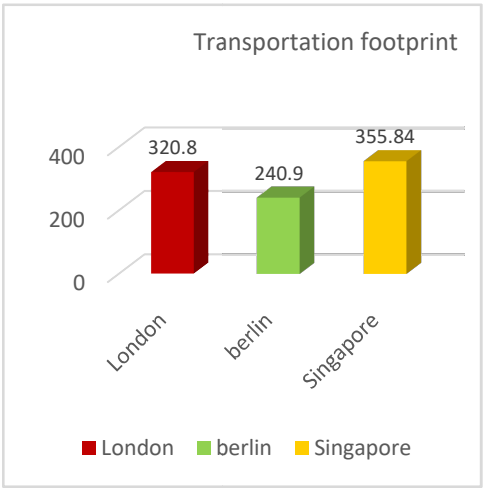
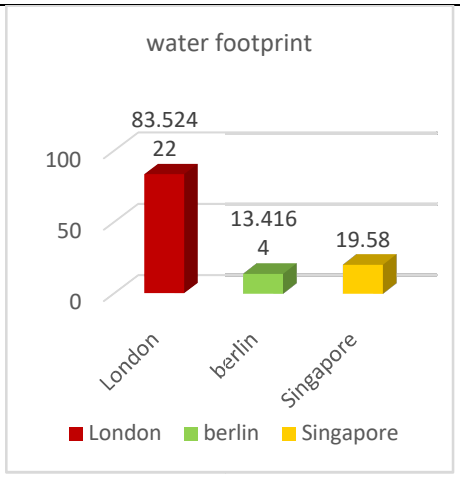
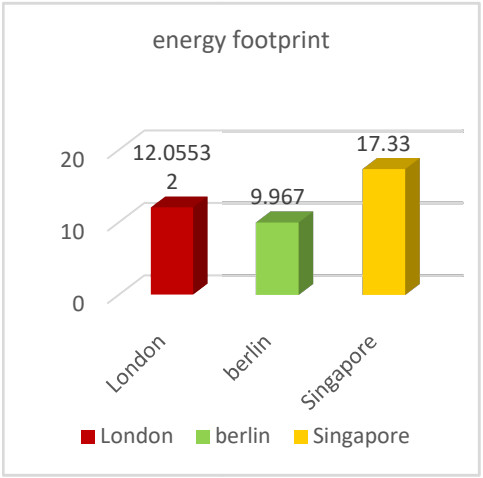


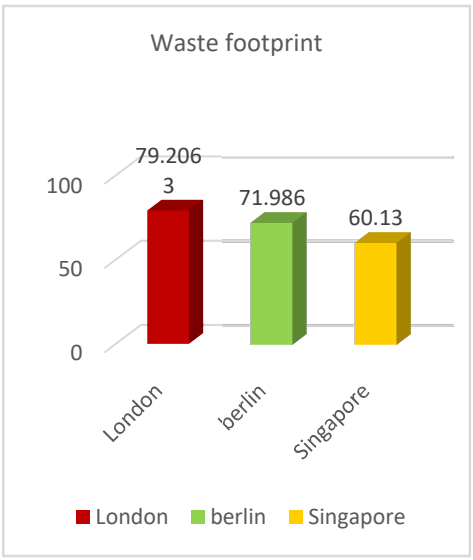
Fig 11. Comparison between Results of Urban footprint cities

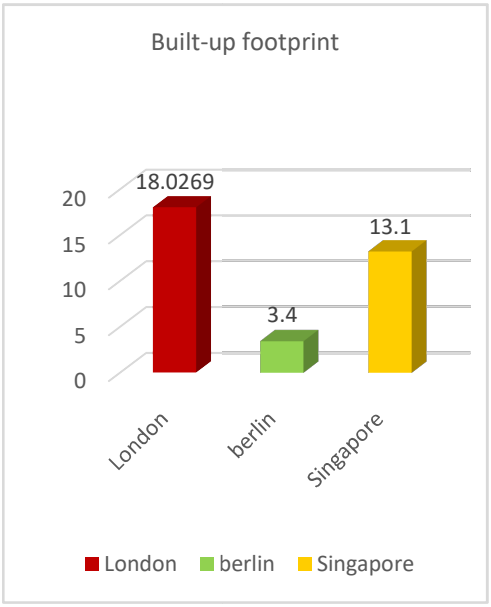
But if we study the urban footprint elements indicators, the urban footprint will be found higher regarding almost the all elements in London than the other two cities followed by Singapore and then Berlin. In fact, it is found that this order is more credible to express the sustainability impact and practices of urban city and its various sectors on the environment and more reflective of the sustainability initiatives of each city. However, this difference in results indicates that the population in cities has an unquestionable impact on the value of the individual ecological footprint and that should be put in consideration.

Table 7.
Comparison between Results of Urban footprint cities.

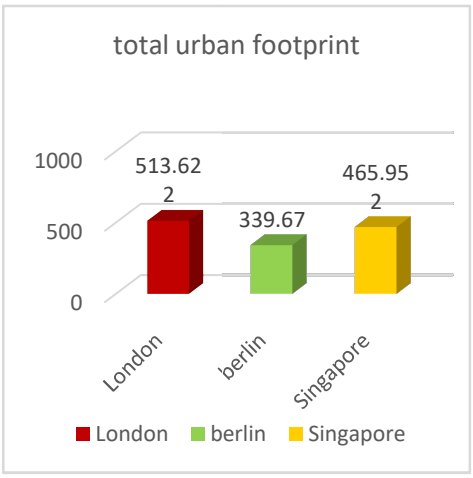
Urban Footprint Elements	City	The comparison	Results
Transportation footprint	**London city**	The transport footprint in London is 320.08 gha with a road area equals 2.25 ha and the CO_2 emissions from transport energy are 643,22 tons of CO_2. Consequently, emissions from transport maintenance, equivalent to 40% of transport energy emissions, are 289.45 tons of CO_2. Based on these rates, the transport footprint was calculated as a sum of the following total values: footprint built-up area 5.68 gha, energy footprint of transportation 217.33 gha and footprint transport maintenance 97.79 gha. It is clear that the energy footprint, related to the value of the transport footprint in London, is the most influential due to the high proportion of private cars as explained earlier in addition to the city dependence on non-renewable and non-clean sources of energy.	 It is clear from the comparison of transport footprints in the three cities that the main effect is the energy used in
	Berlin	Berlin has an area of 1.3286ha, produces 484.9 tons of CO_2 resulted from transportation energy and 218.21 ton of CO_2 is the result of transportation maintenance. Based on these rates and the application of the formula for the urban footprint, the built – up footprint equals 3.34 gha The energy footprint of the transport equals 163.83 gha and the maintenance of transport equals 73.72 gha. Thus, the total value of the Berlin transport footprint is 240.9gha. It is clear that Berlin's transport footprint is better than of the two other cities:	

		Singapore and London and this is due to clean energy policies and dependence on walking, grading and public transport.	transportation. This is due to several reasons: 1- The type of energy used in transportation. 2. The size and reliability of public transport networks. 3- The city planning method and distribution of traffic networks. 4-The dependence degree of population on public transportation and their preference to it in comparison to the other vehicles.
	Singapore	Singapore's transport footprint is equivalent to 355.8392 gha and this value is the result of the total road footprint of 3.608 gha, the energy footprint of transportation 242.917gha and the maintenance 109.31gha. Based on road area rates and carbon dioxide emissions, the road area is 1.432 ha and produces 718.961 tons of CO_2 produced by transport energy and 323.53 tons of CO_2 resulting from transport maintenance. The high value of the footprint is due to the existence of a huge network of transport underground and above ground as the city has exploited its maximum area because of its limited space.	
Water footprint	**London city**	Water consumption in London is 910.25 mega liters which is a huge amount, but this is because this value covers 10 million people 320.80 gha. Thus, the water footprint in London equals 320.8 gha.	 From the above, it is clear that the city of Berlin has the least footprint of transport and it goes back to: 1. Population consumption pattern of water, 2. Low water infusion rates. 3. The living level of individuals. 4. There is no doubt that the population has a direct impact on the size of the water footprint and that is why the value of water footprint in London is significantly higher than the other two cities.
	Berlin	Water consumption of Singapore 138.1675 mega liters. Thus, the value of water footprint is equal to 12.67gha.	
	Singapore	Water consumption of Singapore 213.38 mega liters, Thus, the value of water footprint is equal to 19.58 gha.	
Energy footprint	**London city**	The average emissions of energy in the city of London are 35.68 ton of co_2. London has many sources of energy, but it depends mainly on gas and electricity and therefore the rate of energy footprint is 12.06 gha. This value is due to the high proportion of energy consumption in industries and commercial areas.	 It is clear that the city of Berlin has outperformed the other two cities in this respect due to its great dependence on the clean energy sources and the method of dealing with available energies. It is also better to turn to renewable sources of energy.
	Berlin	The city of Berlin relies heavily on renewable energies, reducing the proportion of emissions to 29.5 ton of co_2. Thus, the value of the energy fingerprint is equal to 9.97gha	
	Singapore	Despite the fact that the city is not dependent on renewable energies, it relied on natural gas to supply the city with energy resulting in 51.32 tons of co_2. Thus, the value of the energy fingerprint is equal to 17.33gha.	

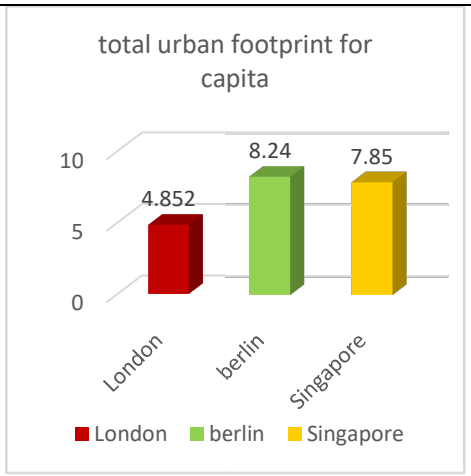
<table>
<tr><td rowspan="3">Waste footprint</td><td>London city</td><td>The rate of waste in the city is large resulting in 234.43 tons of co_2, so its waste footprint is equal to 79.21 gha.
The high value of the waste footprint is attributable to the behavior of the population and the reduction of recycling in the city on which the city is working to improve.</td><td rowspan="3"> 

It is clear that the high waste footprint of London and Berlin reflects the high standard of living of both cities and their lifestyle.
1. Living standards of individuals within the city.
2. Awareness-raising on waste rationalization.
3. Recycling and using waste as a resource to boost development.</td></tr>
<tr><td>Berlin</td><td>Berlin Waste footprint equals 71.98 gha. It comes from carbon emissions equal to 213.05 ton of co_2. The waste footprint reflects the behavior of the population in dealing with waste as they are responsible for 79% of the waste. However, the government is making efforts to raise recycling.</td></tr>
<tr><td>Singapore</td><td>In Singapore, waste is released 177.99 tons of co_2, so the waste footprint is equal to 60.13 gha.
Singapore’s waste management policies are strong and strict. The government has set a target to recycle 65% of waste by 2020 up from 56% in 2008.</td></tr>
<tr><td rowspan="3">Built- up footprint</td><td>London city</td><td>Built -up Area is 7.15 ha. Therefore, London built-up footprint is equal to 18.03 gha.</td><td rowspan="3"> 

It is noted that the built-up footprint is the least one among the elements of the other footprints, as it depends on the proportion of buildings only in the city. This refers to the area of agricultural land which referred to in previous researches.</td></tr>
<tr><td>Berlin</td><td>Built -up Area is 1.35 ha. Therefore, Berlin built-up footprint is equal to 3.39 gha.</td></tr>
<tr><td>Singapore</td><td>Built -up Area is 5.18 ha. Therefore, Singapore-based built-up footprint is equal to13.05 gha.</td></tr>
</table>

<table>
<tr><td rowspan="3">Total urban footprint</td><td>London city</td><td>The total number of elements of the urban footprint of the city of London is 513,62. It is the highest value in comparison to the studied cities.</td><td rowspan="3"> 

Berlin is clearly the best indicator of sustainability; this is due to the sustainable practices of the city followed by the city of Singapore and then the city of London.</td></tr>
<tr><td>Berlin</td><td>Total elements of the urban footprint of berlin are 339.67 which are less compared to the cities studied. This is due to the sustainability practices practiced by the city.</td></tr>
<tr><td>Singapore</td><td>Total elements of the urban footprint of Singapore are 465.95 gha.</td></tr>
<tr><td rowspan="3">Total urban footprint for capita</td><td>London city</td><td>The value of the urbanization of the population of the city is 4.85.

Here the low value of the urban footprint of London can be noted.</td><td rowspan="3"> 

It is clear here that London is the best city in urban footprint compared to the city of Berlin and Singapore due to the high population.</td></tr>
<tr><td>Berlin</td><td>The value of the urbanization of the city population is 8.24.</td></tr>
<tr><td>Singapore</td><td>The value of the urbanization of the population of the city is 7.85.</td></tr>
</table>

V. CONCLUSION

from the urban footprint analysis and discussion of the previous cities (London, Berlin, Singapore), it is found that the urban characteristics are the main impact and the controller as well on the urban footprint value and they are the guiding lines for any plan of a sustainable city as following:

A. The Civilized Texture and the Urban Pattern:

The urban pattern is the main impact on the urban footprint as it affects the roads designing, the transport networks size and the vehicles traveling distances as well. In indirect way, it may affect the vehicles type, their size in the city, the population behavior, their choices and the used energy in transport. The urban pattern affects the used infrastructure services size in the city and the used energy. For example, the integrated planning pattern of Singapore is considered the best environmentally in the used infrastructure service size in comparison to the other two cities: London and Berlin that are distinguished by passing different ages.

B. The Land Use, the Services Distribution and the Cities Centers:

The distribution way of the services and the cities centers really affects the urban footprint, especially the transport footprint, the access distance to services and the traffic congestion as well. Also, the distribution percentage of land use affects the used energy footprint of the different buildings. In London, for example, it is found that there are a great number of administrative services centers in the city center and it also includes the greatest percentage of the city area compared to the residential buildings. In Berlin, on the other hand, there is an increase in the residential buildings, but over the horizontal expansion. In Singapore, the services centers are distributed on the city outskirts in different parts that totally cover the city.

C. Population Density:

The population density impact appears in the final value of the urban footprint and this means it does not obviously affect the urban footprint elements. It finally reflects the waste level of the infrastructure networks and the related services to the city. Thus, it is necessary that the services amount and the infrastructure should be suitable to the population number. Also, the city area should be exploited to have a great number of populations and this number should be employed with services in a correct way. It is also clear that Berlin has surpassed in the sustainability practices more than London and Singapore. These services and the area are more than the city population and it is opposite London that services its practices and seeks to sustainability for more than 10 million populations and this indicates a less urban footprint for the individual.

D. Building Density:

The buildings designing pattern is different regarding the height, the horizontal expansion or the housing patterns (connected housing, detached housing, skyscrapers, etc.) or the buildings percentage to the other city planning elements. There is no doubt that this affects the urban footprint value as the transport footprint, infrastructure and energy footprint, etc.

E. Living Pattern and Standard (Consumption Patterns):

There is no doubt that the living pattern and standard affect the way of choosing the public transportation means or the private car or depending on walking and this also affects the urban footprint. The waste amount by population and the way of dealing with it through detaching, recycling or over wasting is a living standard that affects the urban footprint. The way of choosing the house, either detached or common, is also one of the living standards that affects the urban footprint. That is obvious in the values of the urban footprint elements in Berlin, London and Singapore as the consumption level increases in London more than in Singapore. Yet, there is another element which the culture and general awareness is, and this appears in that Berlin has surpassed the other two cities.

F. The Economic Standard and the Political Situation:

The economic standard surely affects the possibility of controlling the urban footprint value and its different elements. This appears clearly in the ecological footprint value of the countries with high economic standard as its ecological footprint increases more than the countries with low income. There is also no doubt that this follows the consumption pattern of population that is affected by the economic standard of its population.

The political situation and decisions control the tendency towards sustainability or vice versa and this means it controls the urban footprint values and it is also reflected on the planning decisions. This appears in planning London and Berlin as the organic structure of these cities has many structures related to ages of the city. These ages affect the city form, its activities and the movement in it the ecological awareness and management follow the city administration that seeks to control the environmental behavior of its population.

G. Dealing with Consumption Outputs of Emissions and Solid Wastes:

There are many methods of dealing with wastes through using methods of decreasing the wastes amount or recycling, but at the end the best method is to transferring wastes to a national resource that can be benefit and reduce thinking of how to get rid of it. Choosing the correct method depends on the waste amount and the available potentials that can be exploited as much as possible.

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