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RESEARCH ARTICLE

URBANIZATION TRENDS AND GREEN DEVELOPMENT POLICIES IN RWANDA: A DESCRIPTIVE ANALYSIS

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ABSTRACT

Current socio-economic and infrastructures development efforts are sustained by the use of environmental resources. This, sometimes, may leave environmental deleterious effects if the principles of sustainable development are not well integrated into development planning. It is against this background that sustainable cities, green building or sustainable construction as well as green economy are all embraced by sustainable development principles as the drivers of human welfare which support the theory of environmental sustainability and sustainable utilization of natural resources. The purpose of this article was to analyse urbanization trends and green development policies globally, with a particular focus on Rwanda, looking at green cities and green buildings. The findings from the study revealed that the world's areas are urbanizing with an increase in more urban residents in different countries because the United Nations' projections show that percent of urban will move from 29.6% in the year 1950 to 66.4% in the year 2050. The same trend in urban residents was projected in Rwanda where the Government of Rwanda identified an urbanization target rate of 35% by 2020 whereas UNPD projected 33.5% urban growth for Rwanda by 2020. The projections show that with the current ongoing development, this trend will continue in six secondary cities of Rwanda. Rubavu and Musanze cities followed by Nyagatare city are expected to have an increasing number of urban population. But, urban households are projected to increase in Rubavu city (36.7%); Nyagatare city (20%) and Musanze city (17.7%) in the year 2020. As the result, Rwanda has developed Green Growth and Climate Resilience "National Strategy for Climate Change and Low Carbon Development", the National Roadmap for Green Secondary City Development, introduction of Rwanda Building Code and the National Housing Policy together with the creation of Rwanda Green Building Organization (RWAGBO), the Rwanda Green Building Minimum Compliance System, etc. led this green transformation for cities in Rwanda. Now Rwanda is one of the leading countries for green growth in Africa and a member country of Global Green Growth Institute (GGGI). Enhancing the role of policy and green development strategies with sound liabilities rules will drive the green growth vision in order to sustain green economy with sustainable cities.

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INTRODUCTION

Environmental burden is an issue that affects world citizens and they have the right to demand that corporate responsibility be properly defined to take into consideration these concerns (Madu, 2007). Thus, Clark (2009) highlighted that the impacts of urbanization and climate change on the world's environment and populations are arguably two of the most pressing issues facing the world today. Today, as cities prepare to design their futures, urban complexities have grown, challenging cities to achieve not only inclusiveness but also resilience to climate change. Cities need to transform themselves for a greener future, consuming less carbon and reducing their ecological footprints on surrounding hinterlands.

There is thus now a demand for low or zero carbon cities. Glimpses of that vision emerged in 1992 at the Rio Earth Summit as Local Agenda 21, which cited the need to develop local agendas for sustainable living in the 21st century, alongside commitments to achieving the Millennium Development Goals (MDGs). This vision was renewed during the Rio+20 United Nations Conference on Sustainable Development in June 2012 (UN, 2012 and ADB, 2012). Two issues that at present are not considered to the extent their impact merits, particularly in regional and urban planning are (1) the rapid expansion of urban centers into their "fringe zones" (peri-urban, peri-agricultural, agricultural and undeveloped land) and (2) the impact of urbanization on ecosystem sustainability (Madu, 2007). The Green City and promotion of green development recognize that cities are dynamic, have limited resources, need resilient infrastructure

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(hard and soft), and are able to deliver the quality of life benefits expected by its residents. Cities can also provide greater opportunity for the private sector to engage and deliver green development outcomes (ADB, 2015). Cities are the growth engines of the future, offering their populations greater opportunities for education, employment and prosperity. Yet, the negative effects of their growth can also result in traffic congestion, informal settlements, urban sprawl, environmental pollution, exploitation of resources and a significant contribution to climate change (Siemens AG., 2012). In their report, Hammer *et al.* (2011) pointed out that within the next decade, there will be nearly 500 cities of more than a million people, including several megacities with a population exceeding 20 million. As key engines of economic growth, job creation and innovation, but also as major contributors to global warming and environmental problems, cities are at the heart of the transition to a green global economy. Relatively high densities in urban development are a central feature of green cities, bringing efficiency gains and technological innovation through the proximity of economic activities while reducing resource and energy consumption. Urban infrastructure including streets, railways, water, and sewage systems come at considerably lower cost per unit as urban density rises (Pankaja and Nagendra, 2015).

Existing literature

The concept of green city: Cities around the globe are trying to figure out how to grow green (i.e., how to generate economic activity that preserves and enhances environmental quality while using natural resources more efficiently). Though the path to reducing human impact on the environment is clear, we are less sure about how to grow our economies and benefit society's least advantaged members at the same time in other words, how to link the three E's (environment, economy, and equity) of development (Chapple, 2008). Green urban areas have the potential to play an important role in cities: on the one hand, they can contribute to climate change mitigation by absorbing carbon from the atmosphere, as well as providing an area to absorb rainwater, and offering shade; and on the other they can improve general and mental health, by providing an opportunity for social interaction and increasing an individual's quality of life (Eurostat, 2016). City governments play a critical role in addressing the global challenge of climate change. Though output in cities is responsible for the majority of global carbon emissions, a groundswell of local initiatives has placed local government on the front lines of environmental management. Cities in many ways are bellwethers and testing grounds for emerging trends in climate solutions. In light of these developments, during the 2008 OECD Roundtable of Mayors and Ministers, Secretary-General Gurría proposed, Momentum is building to mainstream policies for the 'green economy' and climate smart cities (OECD, 2009).

Therefore, as Press Backgrounder (2013) report referred Green city to as Sustainable city, it was highlighted in the report that a *sustainable city is a city that is taking an intelligent, long-term collaborative approach to tackling the economic, social and environmental challenges that arise when more and more people come together in dense, compact areas, stretching already scarce resources*. The transition of cities through the development curve can correspond, but not always, with that of the transition to different stages of a "green city." As resources and capacity permit, the investments taken in cities

influence how quickly and effectively this transition takes place. However, this correlation is not always neat. The economic status of a city does not always translate into higher investment or achievement of green development (ADB, 2015). According to OECD (2009) report, "Green cities" have also not been immune from the effects of the economic crisis: a tight credit market has limited the range of environmental projects that governments can realistically pursue. At a moment when momentum has been building for cities to go green, it is unclear how their governments can attain the necessary funds to engage more actively in climate change adaptation and mitigation projects or if they can (within the context of allocation of funds from the national fiscal stimulus package), priorities could be given on short term objectives ignoring long term challenges. According to RoR/MINALOC, (2012) revised National decentralization policy the GoR considers urbanization a strategic driver of economic development and a panacea for demographic pressures, sustainable land use and employment. However, the process of urbanization and urban development should be planned, controlled and well directed. It is thus reported that the earlier focus on creating and classifying urban centers as cities, municipalities, towns and trading centers, has not received sufficient attention.

The concept of green building: Green buildings, also known as "Green construction" or "Sustainable buildings" refer to a structure and using the process that is environmentally responsible and resource efficient throughout the building's life-cycle (Hema, 2012). According to Satterfield (2009) research report, the term "green" refers to environmentally friendly practices from building design to the landscaping choices. It also encompasses energy use, water use, and storm water and wastewater reuse. Buildings can be rated for their environmentally sustainable construction. One such rating system is the LEED (Leadership in Energy and Environmental Design). This building rating system was developed by the U.S. Green Building Council (GBC) and was created to: (1). Define "green building" by establishing a common standard of measurement; (2). Promote integrated, whole-building design practices; (3). Recognize environmental leadership in the building industry; (4). Stimulate green competition; (5). Raise consumer awareness of green building benefits; and (6). Transform the standard building market to a green building market. Owing to rising public interest in sustainable and ecological solutions, the last few years have resulted in the establishment of numerous framework conditions that facilitate the use of energy-saving technologies, energy sources that are easy on resources and sustainable products for the property sector (Bauer *et al.*, 2010).

New approaches to green building in Rwanda: Industrial material costs are very high in Rwanda, which suffers from excessive transportation costs and import duties on imported materials, very high energy costs, and a lack of water, wastewater, and electrical infrastructure in many areas. By balancing natural, local materials with careful selection of imported materials and equipment, the Rwandan building designer can achieve a good balance between durability and low environmental impact with more obvious financial and environmental advantage than in many other countries (Rollins, n.d). The National Housing Policy (March 2015) with its three pillars, covers the aspects of access to housing, resource efficiency, land, infrastructure, skills development, enhancement of the local construction industry, construction

materials and technology, townscape and livability, and public responsibility. The Policy Pillars are: 1) Public Benefit, 2) Resource-Efficient Planning, Green Technology, and 3) Professionalism and Governance and Partnership. Thus, for an improved urban functionality and compactness, adequate plans and management practices need to be operationalized and mainstreamed to ensure efficient land use, economic growth environmental protection and social well-being. Economic opportunities and qualitative social facilities are among the pull factors which increase the attraction of urban areas, with focus on an enhanced quality of life (RoR/MININFRA, 2015). According to REMA (2016), Rwandan architects and construction industry have been urged to design and build green and sustainable structures in order to help the country achieve its vision of becoming a green and climate resilient country by 2050. Thus, the government of Rwanda launched Rwanda Green Building Organization (RWAGBO) in pursuit of a green growth approach to economic development favoring the development of sustainable cities and villages. The organization will also supplement the role of Rwanda Building Code and National Housing Policy adopted in 2015, as well as the 2011 National Green Growth and Climate Resilience Strategy. Additionally, RWAGBO will also help Rwanda to implement the recently adopted Kigali Amendment to the Montreal Protocol, by minimizing the use of artificial air-conditioning equipment in houses which emit dangerous greenhouse gases such as hydrofluorocarbons (HFCs) that cause climate change (REMA, 2016).

Linking green economy with green cities in Rwanda: In the last 15 years, the Government of Rwanda (GoR) successfully designed and implemented a broad set of policies and programs of economic reform and decentralization to enhance local capacity. High level commitments of GoR are highlighted in the 7years Government program (2010-2017). GoR has recently developed a new “Economic Development and Poverty Reduction Strategy” (EDPRS 2, 2013-2018) as mid-term plan for implementation of Rwanda’s “Vision 2020”, reference document giving the long term orientation for the country’s development (MINISANTE, 2015). According to UNDP (2012) definition, *Green Economy* is one in which the vital linkages among the economy, society, and environment are taken into account and in which the transformation of production processes, and consumption patterns, while contributing to a reduced waste, pollution, and the efficient use of resources, materials, and energy, will revitalize and diversify economies, create decent employment opportunities, promote sustainable trade, reduce poverty, and improve equity and income distribution.

The strategic plan for climate change and low carbon development recognizes the need for a mix of energy resources to develop a green economy. It identifies challenges, including the accelerated urbanisation and unplanned urban growth particularly in Kigali. According to the strategic plan, it is necessary to implement long-term measures for sustainable urban development. The use of land in urban areas must be efficient and based on high-density development principles, appropriate zoning, and public transport systems, and proper waste management including recycling (RoR/MININFRA, 2012). According to RoR (2011) report about Green Growth and Climate Resilience, Rwanda has the opportunity to leapfrog old technologies and destructive development pathways, and build a green economy, resilient to oil prices spikes and a changing climate.

Thus there is huge potential to attract private investment both domestic investment and regional and global funds focusing on green economy investments in many of the programmes of action, as long as these are made commercially viable. In line with the second Economic Development and Poverty Reduction Strategy (EDPRS2) in its fifth priority “*pursuing a ‘green economy’ approach to economic transformation*”, it was highlighted that the green economy approach favours the development of sustainable cities and villages. Key innovations include: piloting a green city, piloting a model mine and attracting investors in green construction Interventions will focus on green urbanisation and the promotion of green innovation in industrial and private sector. Furthermore, the same report emphasized that the flagship project for green urbanisation will be to work towards the development of a pilot ‘green’ city. EDPRS 2 will initiate a pilot green city to test and promote a new approach to urbanisation that will be a demonstration of sustainable cities for the future (RoR/MINECOFIN, 2013).

A “business-as usual” approach for urbanization of secondary cities is not possible. Rapid expansion of urban boundaries and redevelopment of urban centres should be realized following a green growth approach, to the benefit of the quality of life of inhabitants and to offer an attractive environment for investors (GoR and GGGI, 2015). With this perspective, the purpose of this study was to analyze urbanization trends related with development in global context, discussing the concepts of green cities and green building in Rwanda and finally, explore the approaches for innovation in sustainable construction in Rwanda focusing on exploring green development of green cities and green buildings in Rwanda.

METHODOLOGY

Area description: The study starts with having a global view on the world’s urbanization and green cities development and then, with reference to information withdrawn, the focus was put on Rwanda as a particular case study. Rwanda is a landlocked country between Uganda, Burundi, Tanzania and the Democratic Republic of Congo (DRC), the country is situated in the central part of Africa. It has an area of 2.6 million hectares of which 1.4 are suitable for cultivation. The country is characterized by an uneven mountainous land with an average height of 1,500 m above the sea level. This topography has led Rwanda to be given the name “Land of a Thousand Hills”. The country lies at latitude between 1° and 3° South and at longitude 29–31° East and has a mountainous tropical climate. Despite its proximity to the Equator, the climate in Rwanda is cooled by the high altitude. It is warm throughout most of the country and cooler in the mountains (UNU-IAS and RoR, 2006). Rwanda’s population is growing rapidly with implication on the demographic situation. The most recent population census conducted in 2012 estimated the population to be around 10.5 million people and the population density is the highest in Sub-Saharan Africa (416 inhabitants per square kilometer). The population is essentially young, with 52 percent of all Rwandans under the age of 20 (NISR, 2012; MINISANTE, 2015). Rwanda has now Kigali as the main city and there is a need to develop six secondary cities to supplement Kigali in the process of urbanization and economic development transformation.

Data collection and information gathering: Quantitative (i.e. statistical) data were retrieved from the United Nations’ report

data file. Then, other data with special focus on Rwanda were documented and withdrawn from the reports including that of the Ministry of Infrastructures (MININFRA), Global Green Growth Institute (GGGI) and other institutions. The literature review and subsequent documentation helped getting thorough and useful information for discussion. This was done by referring to different reports, earlier researches conducted and socio-economic development policies developed worldwide in general and particularly in Rwanda. Simple descriptive statistics were used for data analysis and results presentation.

FINDINGS AND DISCUSSION

Urbanization and green cities development: There is an emerging consensus that urbanisation is critically important to international development, but considerable confusion over what urbanisation actually is; whether it is accelerating or slowing; whether it should be encouraged or discouraged; and, more generally, what the responses should be (McGranahan and Satterthwaite, 2014). The findings in *table 1* are the good example of urbanization history for different continents with North America and Latin America and the Caribbean projected to have high percentage of urban residents by 2050. This is to say 87.4% and 86.2 % respectively followed by Europe with 82.0% urban population. In addition, these results give evidence that world's urban areas are increasing which means that this is the development associated with increase in more urban residents in different countries. Therefore, if it continues this way, it will trigger the call for the development of more green development policies to ensure socio-economic and environmental welfare for both urban residents and ecosystem sustainability. According to the findings in *table 1* and based on the current trends in urbanization, projections for future urban growth show that percent of urban population will move from 29.6% in 1950 to 66.4% in 2050. In Rwanda, the country in Africa, efforts made to increase urban areas where the trend in urbanization since 1950 up to the projected figures in 2050, according to the UNPD 2014 findings as summarized in *table 2* are underpinned by the current development policies in place. From the results in *table 1* and *table 2*, there is much evidence that growth in urban population worldwide implies an increase in urban areas as an indicator of development which attracts most population to leave the countryside for the cities. This is coupled with infrastructures development and other socio-economic development facilities which develop in the city as well as in peri-urban areas where the cities expand. The policy of Rwanda to develop secondary cities will play much role in increasing the number of urban areas as well as urban residents in all provinces countrywide so as to reach or even go beyond 52.6% UNPD projection for the year 2050.

With reference to the National Roadmap for Green Secondary City Development, GoR & GGGI, (2015) the Government of Rwanda identified an urbanization target rate of 35% by 2020. Reaching this target requires rapid urbanization of the secondary cities. Therefore, more land will be consumed for city expansion, even if the density increases substantially. Infill and re-development of underused land has to become an integral part of the urbanization strategy. At the same time new neighbourhoods will be required and their planning has to be implemented in a short time. This ambition of 35% is much greater than the projected/expected urban growth of 33.5% by the UNPD as the results in *table 2* prove it. It is also an indicator of efforts being made to expand cities with a particular focus on development of secondary cities.

Therefore, it is unquestionable that the development of those urban areas coupled with an increase in urban population calls for careful planning to ensure the growth of those cities making them more sustainable with less environmental effects by promoting the quality of life of the people and clean environment. Therefore, the commitments for green development will help to make the cities green and more resilient to different effects of climate change. Today, more people living in the cities worldwide are struggling to deal with climate change effects. This is in line with pursuing green economic development in the cities which promotes healthy life of urban residents. According to Eurostat (2016) research report, three French cities more than three quarters of the population agreed that their city was committed to fighting climate change, therefore, in 2015, a majority of the population in 55 out of 79 cities agreed that their city was committed to the fight against climate change. The highest shares of agreement with this statement were recorded in three French cities, namely, Bordeaux (82 %), Strasbourg (81 %) and Rennes (76 %); the corresponding share for Greater Paris was considerably lower at 54 %. By contrast, no more than one third of respondents in the two Italian cities of Roma (33 %) and Palermo (32 %), or the three capitals of Rīga (Latvia; 32 %), Bratislava (Slovakia; 31 %) and Madrid (Spain; 30 %) agreed that their city was committed to the fight against climate change. On the other side, there were only six European cities where a majority of city-dwellers were unsatisfied with the green areas in their city. Consequently, the majority of people living in 73 out of the 79 cities covered by the perception survey declared that they were satisfied with the green areas in their city

It was clearly highlighted by McGranahan and Satterthwaite, (2014) that urbanisation has always raised environmental concerns. Indeed, the links between urbanisation and environmental risks were more evident in early cities, where resource constraints were more localized and environmental health issues loomed large. Although these risks are often not treated as environmental in contemporary accounts of the environment as the third pillar of sustainable development, they have always been and continue to be critically important, particularly to very low-income groups. Rwanda is facing a fast rate of urbanisation and is establishing an urban framework to accommodate growth in a well-managed manner. Major aspects of an urbanisation which is sustainable, are an improved access to adequate infrastructure and services, safety, quality education, healthcare facilities and food security. The welfare of the population is the central point, regardless of gender, age, and economic, social or cultural background (RoR/MININFRA, 2015).

The needs for green and cleaner cities are taken into account in international and national context. There is a lot of evidence that shows different actions were undertaken by city dwellers for example to fight against climate change and promote green areas in their towns. This is clear that green cities are the most desired areas as considered to be healthier places for people to live in. The current trends in urbanization Worldwide, as presented in *table 1* and *2* from UNPD, (2014) report, this forms the basis from which it was concluded that there will be an increase in number of people living in the cities of Rwanda by the year 2050. Since more efforts are directed to developing cities other than Kigali to increase service delivery and boost socio-economic development, the projections of the Government of Rwanda through the Ministry of Infrastructures

Table 1. Percentage of Population at Mid-Year Residing in Urban Areas, 1950-2050

Geographical area	1950	1960	1970	1980	1990	2000	2010	2020	2030	2040	2050
World	29.6	33.7	36.6	39.3	42.9	46.6	51.6	56.2	60.0	63.2	66.4
Africa	14.0	18.6	22.6	26.7	31.3	34.5	38.3	42.6	47.1	51.5	55.9
Asia	17.5	21.1	23.7	27.1	32.3	37.5	44.8	51.2	56.3	60.3	64.2
North America	63.9	69.9	73.8	73.9	75.4	79.1	80.8	82.5	84.2	85.9	87.4
Europe	51.5	57.2	63.0	67.4	70.0	70.9	72.9	74.7	77.0	79.5	82.0
Oceania	62.4	67.1	71.3	71.3	70.7	70.5	70.7	70.9	71.3	72.2	73.5
Latin America and the Caribbean	41.3	49.3	57.1	64.3	70.5	75.3	78.4	81.0	83.0	84.7	86.2

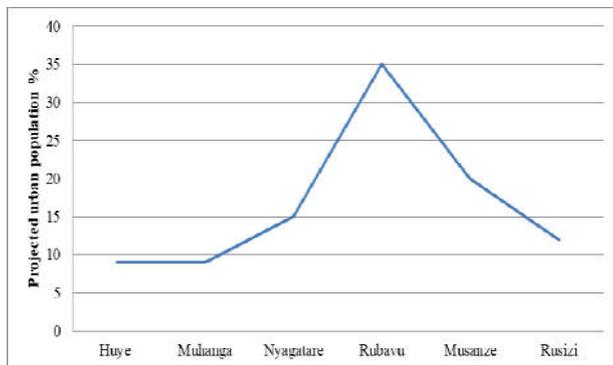
Source: UNPD: United Nations Population Division (2014)

with Global Green Growth Institute (GGGI), *table 3*, show an expected growth of population in secondary cities of Rwanda by 2020. This shows a quick win with regards to UNPD projections.

Table 2. Percent urban population and projected development in Rwanda up to the year 2050

Years	Percent (%) of population
1950	2.1
1960	2.6
1970	3.2
1980	4.7
1990	5.3
2000	14.9
2010	24.0
2020	33.5
2030	41.5
2040	47.2
2050	52.6

Source: UNPD: United Nations Population Division (2014)

**Figure 1. Projected percent urban population in 2020**

The Green Growth and Climate Resilience Strategy (RoR, 2011), highlights that with increasing numbers of people inhabiting urban areas of Rwanda, particularly Kigali, it is necessary to implement a long-term plan for sustainable urban development. Urban areas need to be efficient users of land through high density buildings, appropriate zoning and mass transit, such as bus rapid transit systems. Buildings should be designed to reduce the demand for energy and water and to support waste recycling. Urban areas should also be attractive to pedestrians and cyclists with trees, parks and public spaces, to promote low carbon transport, improve quality of life and reduce the risk of flooding. Rwanda is actively improving the investment in climate by improving start-up and operating conditions for business and industry, addressing water and energy requirements, and establishing a Special Economic Zone in Kigali (SEZ) and provincial industrial parks in urban areas to attract foreign investment. The greening of industry is supported by the Rwanda Resource Efficient and Cleaner Production Centre (RRECPC), a proposed Climate Innovation Centre (CIC) and the National Industrial Policy (RoR, 2011).

Considering the current size of some secondary cities and their anticipated growth enables strategic thinking for the way the cities and metropolitan areas should be structured for the next hundred years. For example, the population of the secondary city of Nyagatare is planned to be four times its current size by 2020, which implies that the urban structure will evolve rapidly (GoR & GGGI, 2015). EDPRS 2 aspires to attain the better quality of lives for all Rwandans through a combination of rapid economic growth of 11.5% per annum and accelerated poverty reduction to a poverty level of below 30% by 2018. The ambitious targets associated with EDPRS 2 mean that the Government of Rwanda needs to apply new ways of thinking and innovation to drive the required step change in implementation for these targets to be achieved (RoR/MINALOC, 2013). As the figures in *table 3* reveal, it is seen that by 2020 different cities will have a projected growing number of urban population with four cities namely Huye, Muhanga and Rusizi whose urban population will be increasing faster compared with the rest of secondary cities such as Rubavu, Nyagatare and Musanze.

Tashobya (2016) stated that the Second Economic Development and Poverty Reduction Strategy 2013/18 (EDPRS II), in the area of green urbanisation, the government aims to enhance the quality of life for Rwandans through sustained growth of 11.5 per cent, and to drive urban green growth and development in other Rwandan cities. Therefore, the Global Green Growth Institute (GGGI) is supporting the Government of Rwanda on the development of secondary cities as green cities which have economic opportunities in terms of job-creation, green infrastructure and investments, anchored on low carbon and climate resilient urban planning. In addition, it is evident (based on the projections in *table 3*) that there will be changes in urban population numbers. Some cities will attain an increasingly urban population number whereas others experience the small growth rate in urban population.

The results show that with an increase in total number of population in the cities, compared with 2012 population, some cities will have exceeded the double of existing population as of 2012 whereas the projected increase in other cities will be small to the extent that it can even be comparable with existing population as of 2012. But in both cases, compared with other cities, Rubavu, Musanze and Nyagatare cities will continue to be the dominant cities with higher number of urban population respectively. *Figure 1* depicts the projected urban population growth in 2020 following the development of those secondary cities. According to the UN-HABITAT (2012) report, it was highlighted that the current pattern of urbanization both in developed and developing countries converges on one and the same model: low density-based sub-urbanisation. Land speculation is associated with indiscriminate conversion of rural land to urban uses in the peripheries; this phenomenon combines with a growing reliance on individual motor vehicles

Table 3. Urbanisation rate (population, households) projection in the secondary cities of Rwanda

	Huye	Muhanga	Nyagatare	Rubavu	Musanze	Rusizi
Urban population (2012)	52,768	50,608	47,480	149,209	102,082	63,258
Urban Population (projection 2020)	103,654	111,901	181,600	421,124	236,638	137,315
Projected increased population	50,886	61,293	134,120	271,915	134,556	74,057
Expected growth (households)	13,048	14,950	34,390	63,236	30,581	16,099

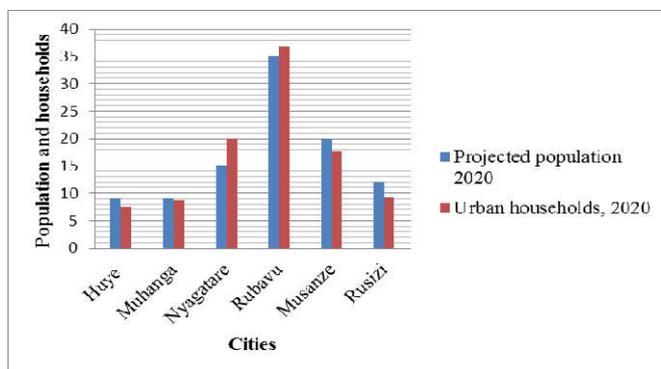
Source: Government of Rwanda/Ministry of Infrastructures and GGI (2015).

and new-fangled middle-class lifestyles to expand urban areas way beyond formal city boundaries.

Table 4: Projected increase in urban households

Cities	Percent (%) projected increase in urban households, 2020
Huye	7.6
Muhanga	8.7
Nyagatare	20
Rubavu	36.7
Musanze	17.7
Rusizi	9.3

Source: Author (2019)

**Figure 2. Urban population and households projected trends in 2020**

Green building (sustainable construction) in Rwanda:

According to the results in *table 4*, an increase in number of population is coupled with an increase in number of households in the cities. The comparison in *figure 2* was withdrawn from both 2020 projections of urban population and urban households increase. The results show that in all cases, the more the population in the city, the more household numbers will increase. This is the case of Rubavu (36.7%); Nyagatare (20%) and Musanze (17.7%) cities' projected urban households. The increase in households in Nyagatare is in relation to the projected rapid increase of its population. Rubavu city is projected to be the first in secondary cities and the second after Kigali city which is hosting a large number of urban populations because MININFRA (2015) policy of National Urbanization highlighted that urban households account for about 15% of the total number of households in the country, with the majority living in Kigali City.

This growth is in fact associated with different amenities and socio-economic development facilities together with other environmental conditions which attract mass population to these cities. As stated by the MININFRA (2015) report, the indicators in urban areas generally show a higher level of wellbeing than in rural areas, driven particularly by the much higher living standards of the urban non-poor. So far, as emphasized by UN-HABITAT (2012) report, cities have been perceived as the 'engines' of national economies and there is no reason to depart from that view. Indeed, urban authorities find themselves, at least notionally, in a position to boost

production in the real sector of the economy at local level, with attendant employment and income generation. If urban responses to economic crises are to be effective on a local scale with positive regional or national repercussions ('multiplier effects'), then efficient, multi-way institutional, policy and budget linkages are required between all relevant tiers of government. Stone (1988) in his study highlighted that the human population and its activities are generally in a state of change. As the result, their environment is subject to growth, decline and adaptation. He further added that a central issue is the spread of settlements, with options relating to urban concentration, size of settlements and their geographical location, giving rise to policies on density, Green Belts, congestion, urban growth and decline, and regional location.

Wasteful expansion of cities in endless peripheries is a major factor behind climate change. Beyond the physical threats from climate change, some cities stand to face an array of additional risks related to the provision of basic services and public goods (water supply, physical infrastructure, transport, energy, etc.), affecting production, local economies, assets and livelihoods (UN-HABITAT, 2012). As the growth of cities and the rising pressure of its inhabitants on resources are to be controlled so as to reduce the effects of unplanned urban sprawl. Rwanda, as the developing country, has set policies for urbanization and green development leading to rational and sustainable resources use. The development and adoption of the National Urban Housing Policy aims at guiding Government objectives and priorities in line with the objectives as laid down particularly in the Vision 2020, the EDPRS and the National Investment Strategy. According to the aims of Vision 2020, about 30% of the population will live in planned cities with access to basic infrastructure necessary to ensure sustainable development (RoR/MININFRA, 2008).

The existing literature reveals that Rwanda has formulated a number of policies enhancing resources use for efficient production and protection of environmental integrity. One of the most important strategies developed for green building highlighted the needs of the buildings to fulfil the environmental friendly features. Therefore, according to RoR/MININFRA (2008) report, the National Urban Housing Policy includes all public interventions within the framework of the urbanisation process of Rwanda in order to constitute the urban structures at national and provincial level, to improve urban management, control development, and the spatial expansion of cities, particularly urban centres using effective planning tools. It was stated in RoR/MININFRA (2012) report, that building design principles should decrease the need for energy and treated water. To achieve low carbon emission and climate resilience, Rwanda will adopt energy and water efficiency standards into building codes, establish an integrated multi-mode urban transport system, and utilise waste as a high-value resource. Therefore, to put an emphasis on building design features, Hema (2012) in his research conducted about green techniques in building construction stated that green building standards focus on making residential and commercial

buildings more environmentally friendly, sustainable and healthier for their occupants. Many builders and designers are implementing green building standards into their designs to create buildings that use environmentally friendly materials where are highly energy efficient and have excellent air quality. With reference to this statement, it is now clear that the policy developed in Rwanda encourages the reduction of environmental unfriendly techniques while designing the buildings. This contributed to resources management and wastes minimization at the same time promoting the wellbeing of the communities living in those buildings. Satterfield (2009) added that a green building may cost more up front but, in the long run, will save money through lower operating costs over the life of the building. The green building approach applies a project lifecycle cost analysis to determining the appropriate up-front expenditure. This analytical method calculates costs over the useful life of the asset. Kigali's new Green Special Economic Zone will investigate financial and fiscal incentives to companies to comply with voluntary energy efficiency and building standards; and in the long-term a green investment index will be established in RDB to attract climate-friendly foreign direct investment by ranking Rwandan companies' environmental and financial performance Green buildings (RoR, 2011).

Conclusion

Sustainable cities, green building or sustainable construction as well as green economy are all embraced by sustainable development principles as the drivers of human welfare which support the theory of sustainable utilization of environmental resources. This led to national and international debates which ended up by taking green growth as the key driver of economic transformation and building sustainable urban environment. Urbanization is taking place on alarming rate worldwide with an increase in more urban residents in different countries because the United Nations' projections show that percent of urban moved from 29.6% in 1950 to reach 66.4% in the year 2050. The same trend in urban residents was remarked in Rwanda over this period from 2.1% to 52.6% respectively. Kigali city is hosting the majority of urban population followed by secondary cities under development. The projections show that with the current ongoing development, Rubavu, Nyagatare and Musanze cities will have more increased urban population. Therefore, urban households are expected to increase by 36.7% in Rubavu; 20% in Nyagatare and 17.7% in Musanze in 2020 because population and households' growth go hand in hand. In this process of pursuing sustainable development, Rwanda has set different policies with respect to different economic development sectors to help in managing the use of resources and improve people's wellbeing at the same time sustaining the environment in both urban and rural areas. For this reason, the Green Growth and Climate Resilience "*National Strategy for Climate Change and Low Carbon Development*" strategy 2011; *National Roadmap for Green Secondary City Development, 2015*, etc. were developed to serve as a roadmap to sustain economy, environment and social welfare. Innovations in building in Rwanda were made where all property developers and the whole construction sector are urged to use locally produced building materials, which are affordable, use low energy and emit less or no greenhouse gases. As the need to encourage the development of green cities and green construction in Rwanda has been a key objective for green growth and climate resilient strategy.

Green building permit, green building certification and guidelines, etc. will be among other basic conditions for those who wish to build private homes or properties for sale or rent, as a way of encouraging green and sustainable building in the country. Made in Rwanda policy came in to sustain those existing initiatives. To cut the long story short, the country is promoting green growth in order to foster green economy, infrastructures and climate resilient country with the main objectives of reducing environmental problems which may result from unsustainable use of nature and natural resources. Supplemented by Rwanda Building Code and National Housing Policy as well as being a member country of Global Green Growth Institute (GGGI), Rwanda Green Building Organisation (RWAGBO) as an organization member of the World Green Building Council, will lead this green transformation to achieve green growth as the objectives to be achieved by the government in its development agenda during the next coming years since there is full government support regarding green urbanisation. The Rwanda Green Building Minimum Compliance System was developed and approved as an annex to the Ministerial Order determining Urban Planning and Building regulations which was officially gazetted in 2019.

Objectives of green development will be sustained by

- Making continuous follow up so as to make sure the building code is respected for property developers.
- Close monitoring during construction works to ensure the compliance with the requirements for different engineering construction companies.
- More efforts on controlling artificial materials introduced in the country to be used in the houses and other daily activities.
- Developing more sustainable methods for urban wastes treatment and management.
- Encouraging clean technology in production and consumption activities/businesses to reduce vulnerability to climate change effects.
- Strengthening the role of policy in urban housing with sound penalties as an incentive to support policy enforcement.

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