



Global
Green Growth
Institute

Republic of Rwanda

National Roadmap for Green Secondary City Development



National Roadmap for Green Secondary City Development

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The Global Green Growth Institute

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The full report should be referenced as follows:

Government of Rwanda and GGGI (2015). National Roadmap for Green Secondary City Development. Kigali

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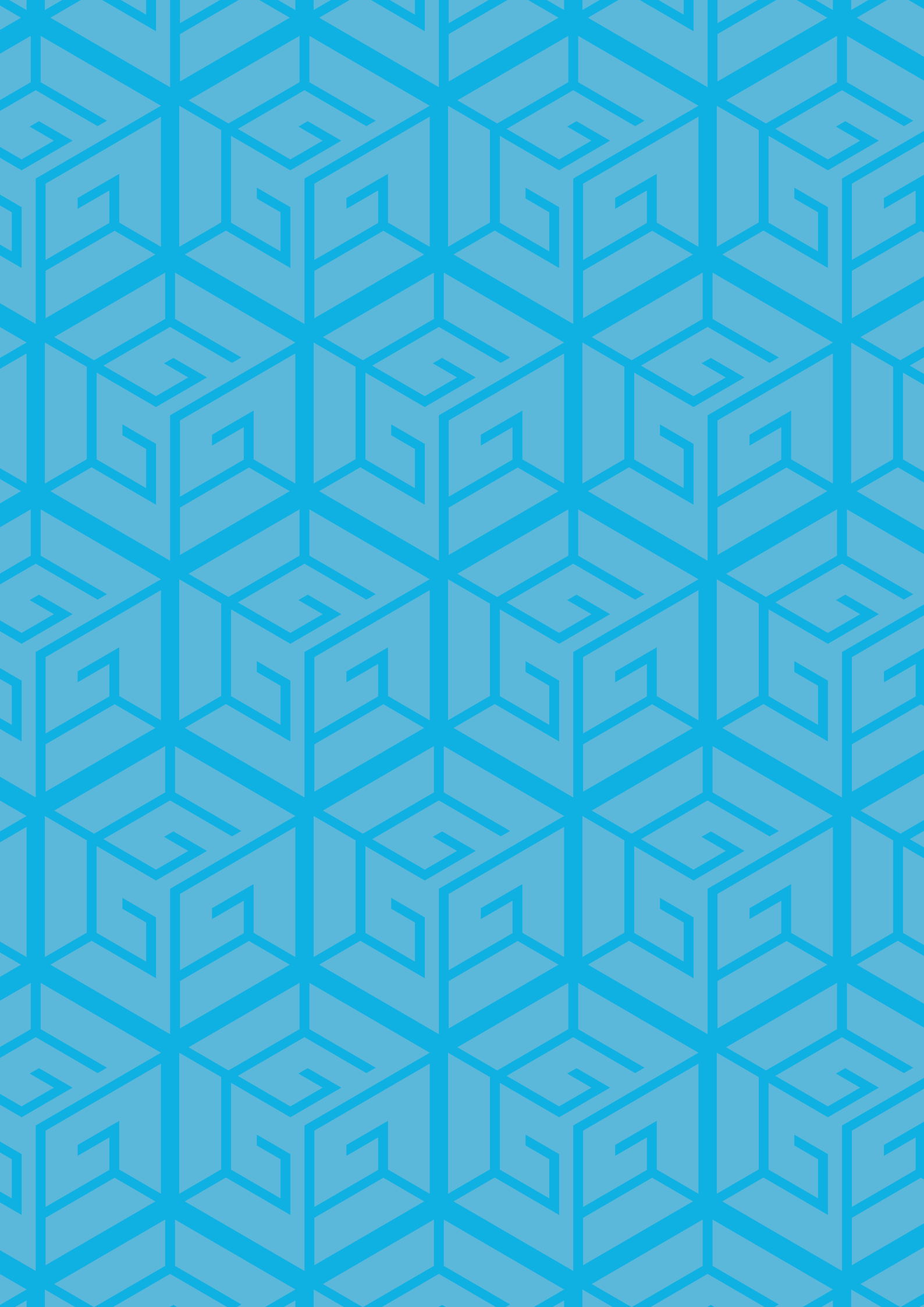
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National Roadmap for Green Secondary City Development

Ministry of Infrastructure (MININFRA)
Republic of Rwanda

Global Green Growth Institute
Green Growth Planning & Implementation (GGP&I)
Rwanda Country Program

December 2015



Our commitment to build green cities



Rwanda is one of the most densely populated countries in Africa with 445 people per square kilometer¹.

In addition, Rwanda is facing high population growth of 2.4% per annum in 2014, with an average urbanization growth rate of 6.4% per annum. Urbanization in Rwanda is concentrated in Kigali City with a 9% urbanization growth rate, posing economic pressures in the distribution of wealth and economic opportunities in one city. With a prosperous annual GDP growth rate of 4.7%, there is an opportunity for intervention to promote a more inclusive development approach.

In order to provide a more balanced urban system, the Government of Rwanda announced, through EDPRS 2, the creation of six secondary cities. The goal of this strategic priority is to ensure more balanced urban growth for the country by encouraging the emergence of secondary economic poles of growth, while keeping the leading role of Kigali.

Great benefits can arise from the urbanization of the six secondary cities, such as connecting more people to efficient water supply sources and electricity, thus positively influencing the quality of their lives. Precautionary measures and early action are needed to avoid health hazards and a disproportionate dispersal of opportunities and wealth among the intended dwellers. This includes considerations of urban planning, provision of infrastructure, and jobs creation.

There is need for efficient planning, implementation and management to capture the benefits of urbanization. The less urbanized areas of the country and the secondary cities in the early stages of development offer a strategic opportunity to adopt a green development approach.

Different green solutions could be applied to the infrastructure sector to reduce the inevitable environmental impact of urbanization and increased human activities. This way, Rwanda would be demonstrating its ability to establish a new development model, linking economic growth, sustainability and social inclusiveness.

With a successful green urban development, Rwanda will become a role model for green city growth for Africa and the World.

The present National Roadmap for Green secondary cities development is a coordination tool and a practical planning instrument, which aims to provide a clear strategic guidance for the Government and other key stakeholders. The proposed green guidelines ensure sustainable growth of the secondary cities of Huye, Muhanga, Musanze, Nyagatare, Rubavu and Rusizi. To this end, the National Roadmap is a direct implementation tool for the National Strategy for Climate Change and Low Carbon Development that was adopted by the Government of Rwanda in 2011.

We are confident that the implementation of this National Roadmap will help develop green secondary cities in a holistic manner, providing new economic and social opportunities to all Rwandans. The development of secondary cities constitutes a major project for Rwanda, and it requires the participation and ownership of the civil society and all government stakeholders.

Hon. James MUSONI
Minister of Infrastructure Republic of Rwanda

Acknowledgment

The National Roadmap for Green Secondary City Development is a result of the collaboration between MININFRA, the lead ministry for urbanization of the Government of the Republic of Rwanda (GoR) and the Global Green Growth Institute (GGGI), an international organization dedicated to developing and diffusing green growth as a new development paradigm.

MININFRA is responsible for initiating, developing, and facilitating urban development programs with a view to enabling the following: providing affordable shelter with due regard to adequate water and sanitation facilities for the population; promoting grouped settlement (*Imidugudu*); and initiating programs aimed at increasing access to affordable energy, water and sanitation, transport infrastructure and related services for the population.

MININFRA is further responsible for supervising the implementation of quality standards and norms, ensuring cost effectiveness, responding to environmental sustainability and safety, and overseeing crosscutting issues in infrastructure development.

This National Roadmap is the third component of the Government of Rwanda and GGGI project entitled “Developing Rwandan Secondary Cities as Model Green Cities with Green Economic Opportunities”, and aims to support economic transformation of Rwanda through green urbanization and green growth, focusing on the development of secondary cities.

Local government officials, department heads, and technicians of the districts of Rusizi, Huye, Muhanga, Rubavu, Musanze and Nyagatare deserve a great deal of recognition for their cooperation during the preparation of the National Roadmap for Green Secondary City Development.

Above all, the National Roadmap would not have been successfully completed without the leadership provided by Permanent Secretary in MININFRA, Mr Christian RWAKUNDA.

The technical teams of GGGI and MININFRA drafted the contents of the National Roadmap.

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Abbreviations and Acronyms

BRT	Bus Rapid Transit
CoK	City of Kigali
DRC	Democratic Republic of Congo
DDP	District Development Plan
DPB	District Planning Board
EDPRS	Economic Development and Poverty-Reduction Strategy
EAC	East African Community
EIA	Economic Impact Assessment
FAR	Floor Area Ratio
FONERWA	Rwanda National Climate Change and Environment Fund
GDP	Gross Domestic Product
GoR	Government of Rwanda
GGGI	Global Green Growth Institute
GHG	Greenhouse gas
GSCI	Green Secondary City Index
ICT	Information and Communication Technology
KPI	Key Performance Indicators
LLDP	Local Land Development Plans
LUDP	Local Urban Development Plan
MPLMUP	Master Plans for Land Management and Urban Planning
MINALOC	Ministry of Local Government
MINICOM	Ministry of Trade and Industry
MINECOFIN	Ministry of Finance and Economic Planning
MINGEPROF	Ministry of Gender and Family Promotion
MININFRA	Ministry of Infrastructure
MINIRENA	Ministry of Natural Resources
MPLMUP	Master Plan for Land Management and Urban Planning
NISR	National Institute of Statistics of Rwanda
NLUPDD	National Land Use Planning and Development Document
NPB	National Planning Board
NR	National Roadmap for Green Secondary Cities Development
NUP	National Urbanization Policy
OSC	One-Stop Center
PPP	Public Private Partnership
REMA	Rwanda Environment Management Authority
RDB	Rwanda Development Board
RHA	Rwanda Housing Authority
TVET	Technical Vocational Education and Training
SWOT	Strengths Weaknesses Opportunities Threats
UN-Habitat	United Nations Human Settlements Programme
UPC	Urban Planning Code
WB	World Bank
WHO	World Health Organization

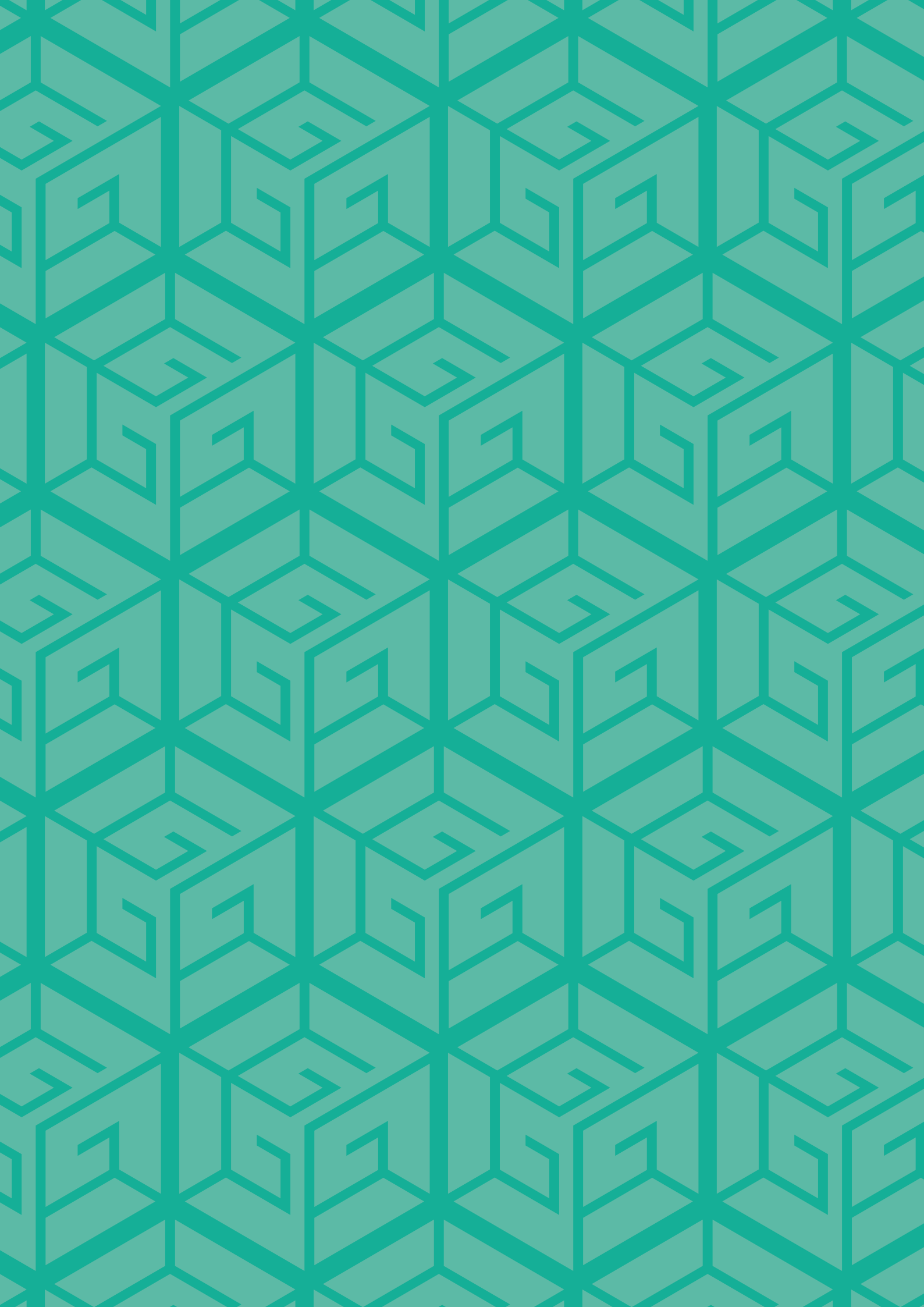
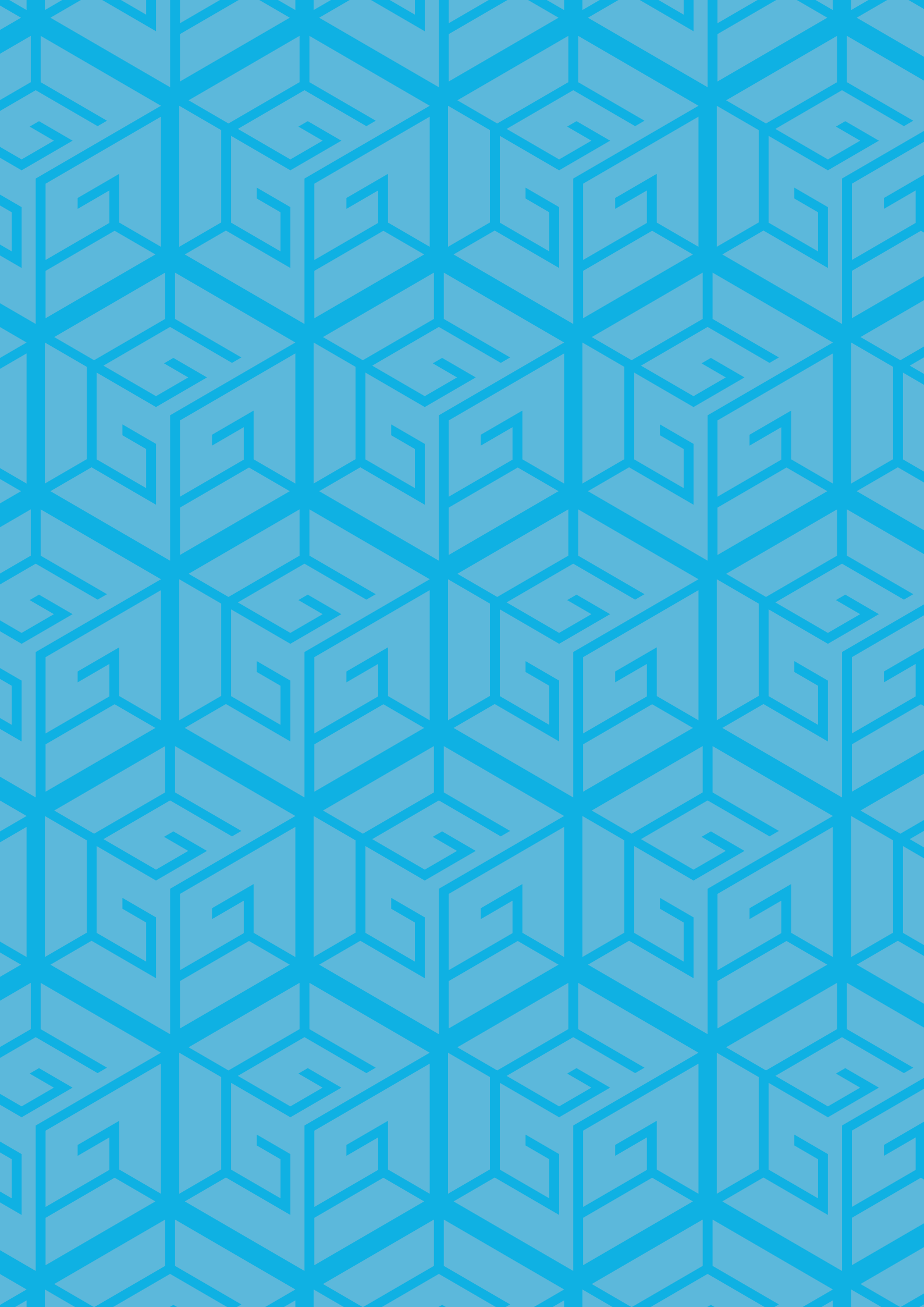


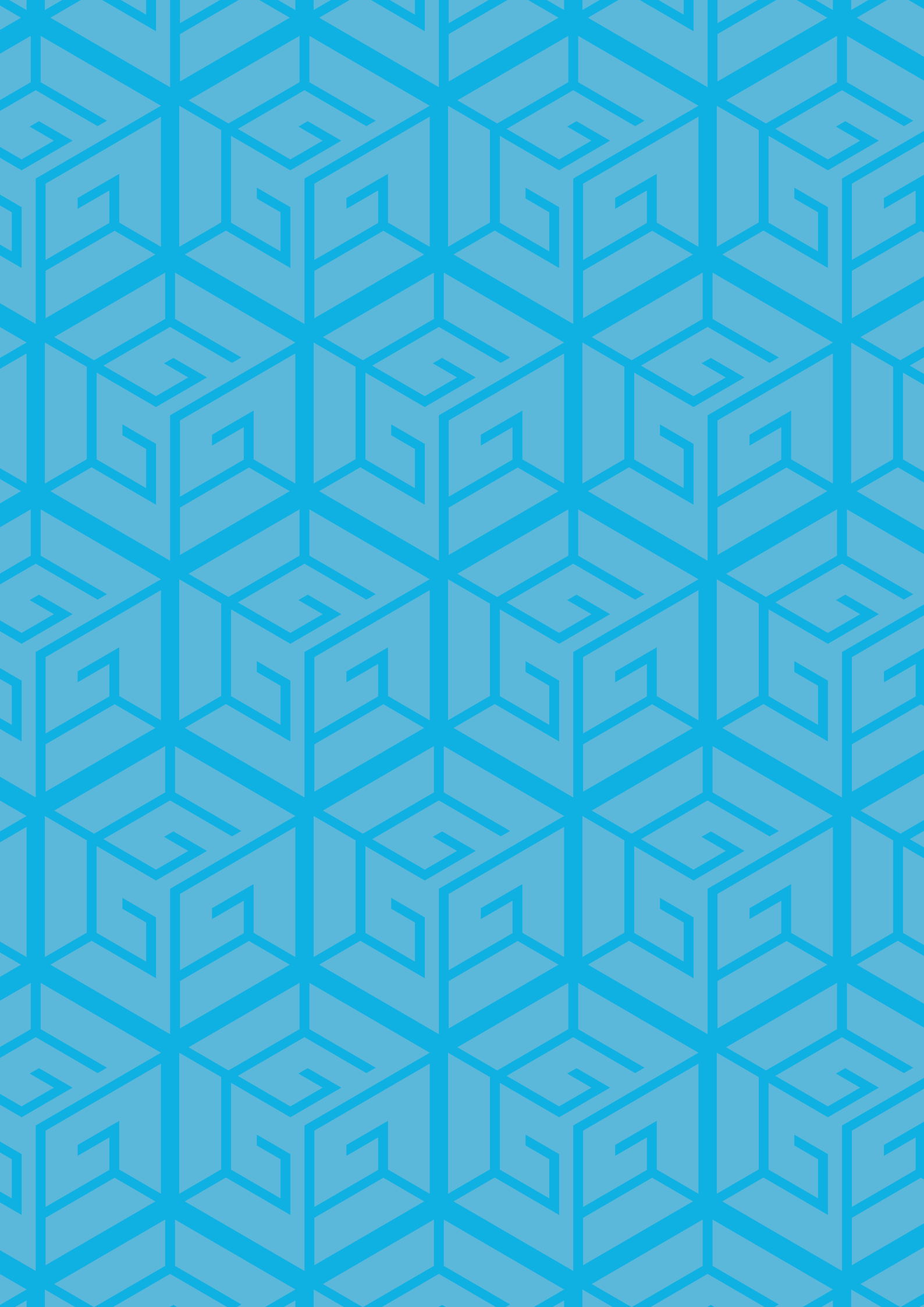
Table of Content

List of Figures	9
List of Tables	11
Photo Credits	13
Executive Summary	15
Incamahe	20
Sommaire exécutif	24
Key Definitions	29
Introduction	33
1.1 Background	33
1.2 Methodology	41
1.3 Foundations, pillars, pull factors, and key actions	44
1.4 The National Roadmap as an evolving tool	46
Vision for green secondary cities	49
2.1 What is a green city?	49
2.2 Vision for green secondary cities in Rwanda	51
Demographic targets and pull factors	55
3.1 Demographic targets	55
3.2 Push and pull factors for urbanization of secondary cities	56
Foundations of green urbanization	59
4.1 Good governance	60
4.2 Urban planning	65
4.3 Safeguards	81
Pillars of green urbanization	85
5.1 Building and construction	87
5.2 Energy production & consumption	97
5.3 Urban mobility	107
5.4 Water production and distribution	119
5.5 Sanitation	131
5.6 Waste management	147
Pull factors of urbanization	159
6.1 Economic growth and job creation	161
6.2 Quality of life	175
District profiles and LED potentialities	179
7.1 District of Huye	180
7.2 District of Muhanga	182
7.3 District of Nyagatare	185
7.4 District of Rubavu	187
7.5 District of Musanze	189
7.6 District of Rusizi	191
Implementation and monitoring	195
8.1 Criteria for investment decision	195
8.2 Monitoring green urban development	197
8.3 Action plans	203



List of figures

Figure 1	The secondary cities of Rwanda
Figure 2	General mapping of the secondary cities project
Figure 3	Foundations, pillars and pull factors of green urbanization
Figure 4	Relation between urbanization and income
Figure 5	A green path toward economic development
Figure 6	Green urbanization
Figure 7	Land value sharing process
Figure 8	Linkage between planning documents
Figure 9	Example of green belts and greenways
Figure 10	Urban heat island effect
Figure 11	Green building market composition
Figure 12	Key ingredients for affordable housing
Figure 13	Building efficiency
Figure 14	Areas in the energy sector affecting secondary cities' development
Figure 15	Hierarchy and evolution of urban mobility and leapfrog opportunity
Figure 16	Range of solutions for sustainable mobility in a green city
Figure 17	Planning a public transport system
Figure 18	Public transport performance
Figure 19	Prioritization of a road network
Figure 20	Example of a delimitation of a Source Water Protection Area
Figure 21	Planning access to improved water
Figure 22	Sanitation systems
Figure 23	Sustainable sanitation cycle
Figure 24	Definition of zones and sanitation facilities
Figure 25	Minimal distances for the construction of a dry pit
Figure 26	Sedimentation / Thickening pond
Figure 27	Unplanted drying bed
Figure 28	Planted drying bed
Figure 29	Co-composting
Figure 30	Biogas reactor
Figure 31	The green solid waste management hierarchy
Figure 32	Generic waste flow in a green city
Figure 33	The green economy
Figure 34	Action plan of the National Industrial Policy of Rwanda
Figure 35	Infrastructure and job creation virtuous circle
Figure 36	Possible economic development corridors
Figure 37	The secondary cities of Rwanda



List of tables

Table 1	Demographic targets for secondary cities
Table 2	Summary of potential push and pull factors
Table 3	Characteristics of good governance
Table 4	Rwanda urban planning documents and their content
Table 5	Planning documents in effect in secondary cities
Table 6	Prospective land needs of secondary cities
Table 7	Capital costs for infrastructure provision by density
Table 8	Green space requirements for secondary cities
Table 9	Housing demand for 2012 and to meet 35% urbanization target
Table 10	Local Building Materials
Table 11	Current energy generation mix in Rwanda
Table 12	Contribution of various energy sources to GHG mitigation
Table 13	Rate of ownership of private transport vehicles per district
Table 14	Impact of renewable resources consumption
Table 15	WHO guidelines on average water use
Table 16	Prospective water needs of secondary cities
Table 17	Access to water (improved water)
Table 18	Volume of waste generated and area required for landfill
Table 19	Employment rate and distribution of jobs sectors among districts
Table 20	Example of green jobs

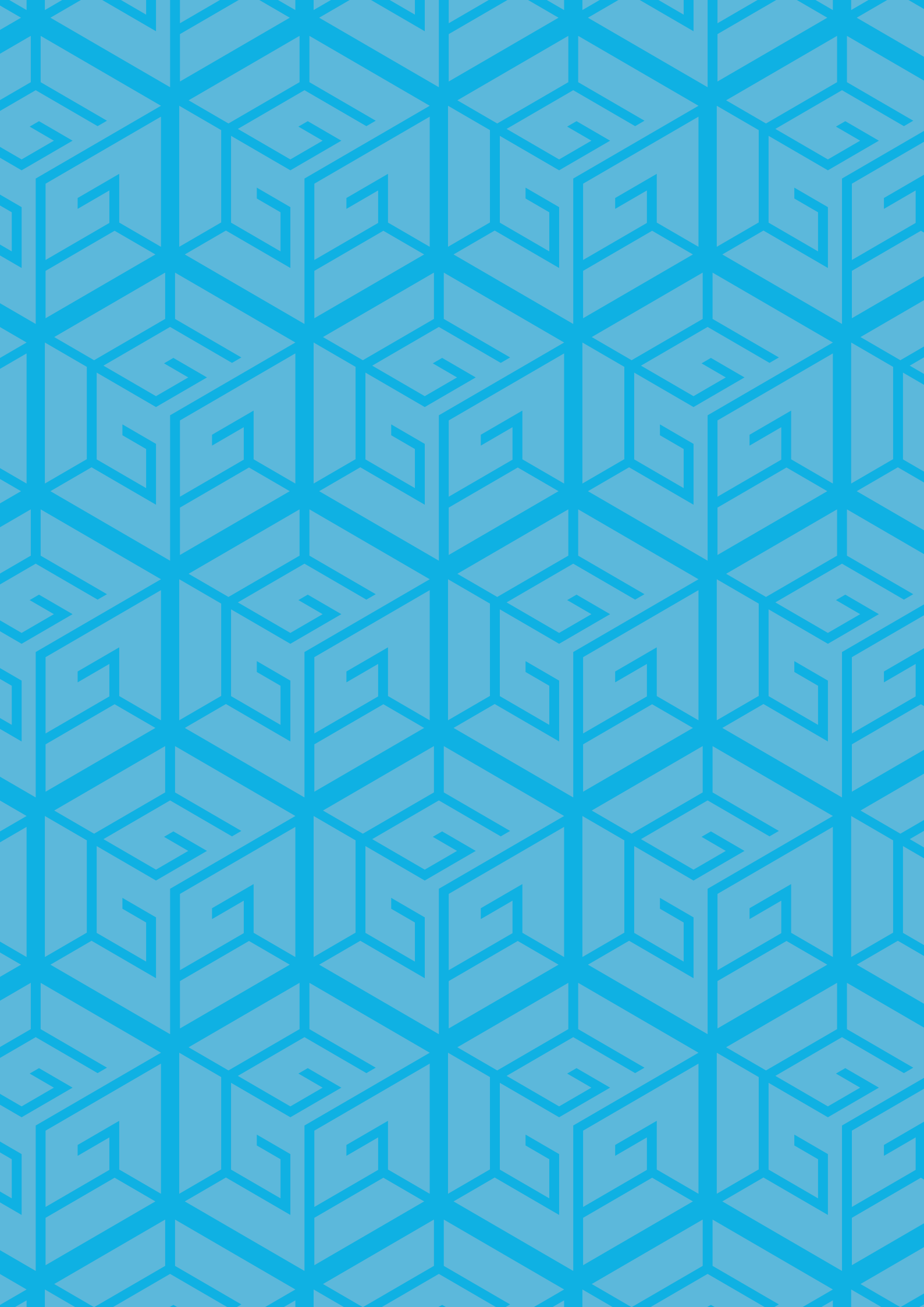
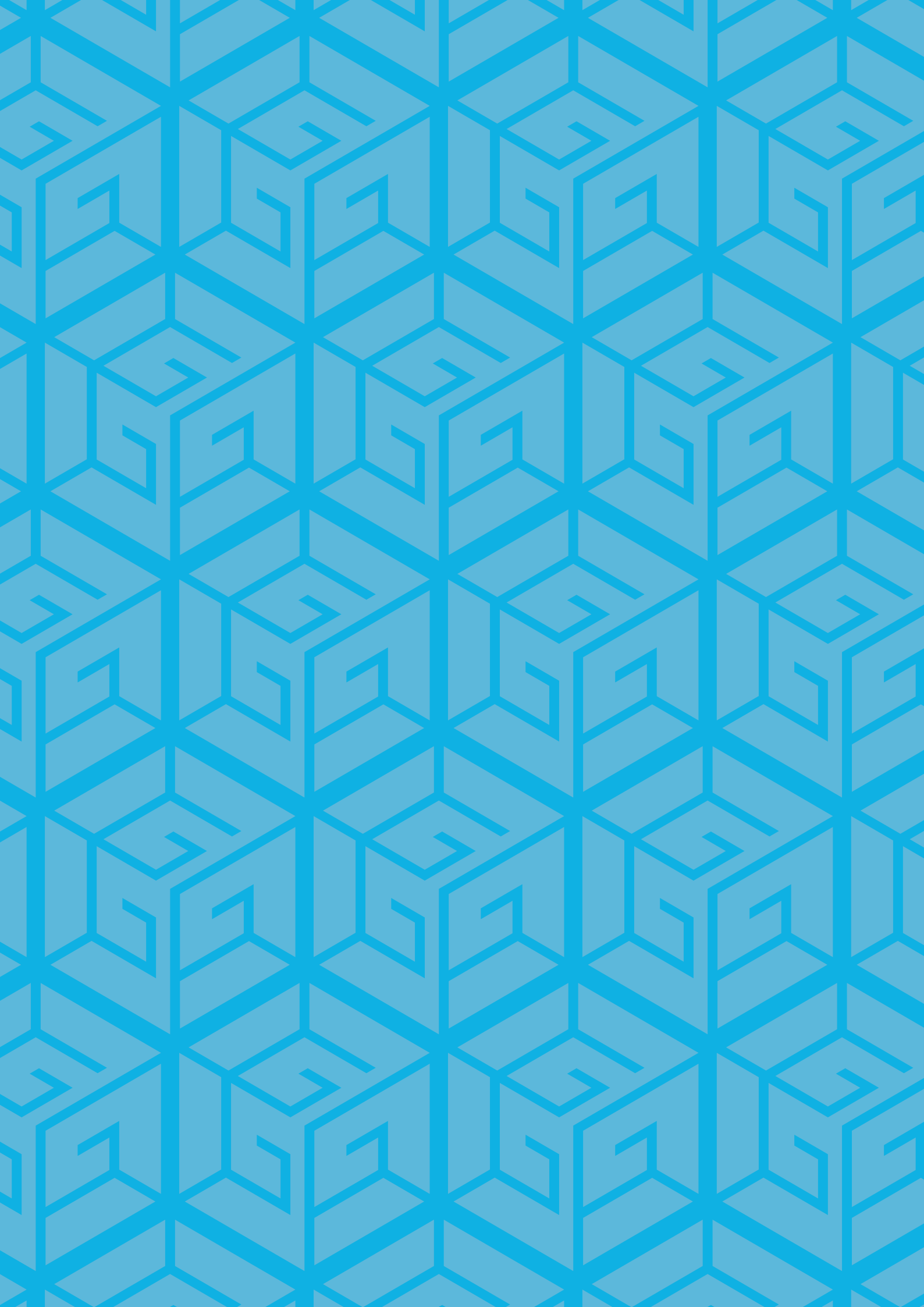


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Page 154	Nduba landfill in the city of Kigali	© Mathieu Belanger / GGGI
Page 158	View from Mount Rubavu	© Mathieu Belanger / GGGI
Page 160	Construction works in Rusizi	© Mathieu Belanger / GGGI
Page 174	View from Mount Rubavu	© Mathieu Belanger / GGGI
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Executive Summary

The National Roadmap for Green Secondary City Development (NR) serves as a practical guide to the Government of Rwanda for planning the six secondary cities that have been identified in EDPRS 2, the Second Economic Development and Poverty Reduction Strategy. In addition, the NR is an operational tool for the National Strategy for Climate Change and Low Carbon Development, where it paves the way for the development of a climate resilient country by addressing climate change and low carbon emission until the year 2050.

The NR was developed by a team of experts from the Global Green Growth Institute (GGGI), specializing in sustainable urban development, in close collaborations with professionals in the Ministry of Infrastructure (MININFRA) of the Republic of Rwanda. The development of the NR responds to the context of current national priorities and actions put forth in Government of Rwanda policies and strategies. The document further draws from local government perspectives from workshop consultations, and is reflective of ongoing work with and expertise from development partners also engaging with the development of the secondary cities: The World Bank and UN-Habitat. Work on the document was supervised by a steering committee consisting of key representatives of ministries and agencies concerned with the development of secondary cities.

The four guiding functions of the NR are to serve as:

- a commissioning tool for the implementation of the EDPRS 2 and the National Strategy for Climate Change and Low Carbon Development.
- a framework for key actions at national level with identified roles and responsibilities for the development of the six secondary cities.
- a guiding document for the process of urbanization and infrastructure development in its aims to achieve green and sustainable growth.
- a national, integrated vision for job creation and poverty alleviation.

Importance of Secondary Cities for Growth

Rwanda is approximately 18% urbanized, which is the lowest in Africa. However, the current average growth rate of the urban population is 4.5%, which is well above the world average of 1.8%. Moreover, this growth is largely concentrated in the capital city, Kigali, which has an annual population growth rate of 9%.

In order to better distribute economic growth across the country and accomplish the national urbanization target of 35% by 2020, the Government of Rwanda has identified six secondary cities to serve as growth poles: Huye, Muhanga, Nyagatare, Rubavu, Musanze and Rusizi. However, these cities currently face challenges in the management and provision of basic infrastructure services to their growing population sizes, which, in turn, affect the ability of the cities to develop their economic prosperity.

Urbanization and Green Growth

A national focus on urban development is a strategic approach to achieve economic growth: cities tend to concentrate economic opportunities, provide a fertile environment for the establishment of wealth, and encourage the exchange of knowledge. However, as cities consume large amounts of resources for survival, they tend to generate pollution, waste and cause irreversible damage to the environment. To this end, human activity from urbanization imposes a major challenge if not planned well.

Anticipating and responding to potential negative impacts generated by unplanned urbanism, enable cities to operate sustainably and mature to a green growth pathway. For example, urban dwellers will face benefits to their health from decreased pollution and improved methods of waste disposal ameliorating their quality of life; the city will face lower maintenance costs from efficient use of land whilst building resiliency against natural disasters; and the environment itself will be preserved through efficient recycling and resource management measures. Furthermore, the multiplier

effect of these sustainability measures spurs further opportunities for urban dwellers, such as the creation of green jobs and the generation of higher innovation levels which spur further green growth developments.

Rwanda possesses the political will and popular ability to avoid the pitfalls of rapid urbanization and holds the advantage of being at the early stages of its infrastructural development. Planning for the growth of the secondary cities in a sustainable framework will increase benefits and avoid negative consequences of urbanization: urban sprawl, traffic and congestion, informal settlements and inefficient public services.

To effectively respond to the complexity of urbanization and achieve a greener growth path, there is a need to distinguish the characteristics of urban growth. The NR has established a framework by categorizing these characteristics as follows:

- **Fundamentals:** good governance, urban planning, and environmental and social Safeguard policies;
- **Pillars:** building sector, energy, urban mobility, production and distribution of water, sanitation, and waste management;
- **Pull Factors:** economic development, job creation and quality of life.

The NR provides green guidelines for planning the sustainable growth of the six secondary cities through these key characteristics: the fundamentals, pillars, and pull factors of urbanization.

Foundations of Urbanization

The foundations of urbanization are the bases for effective implementation of the pillars of urbanization. Without the consideration of these foundations, urban development is likely to be carried out in an unorganized manner, with inconsistent interventions, unaligned initiatives, and benefits that are not socially inclusive.

The first foundation of urbanization is **good governance**. For the developments of the secondary cities there is a need for government alignment of proposed urbanization measures from national to local level, and a need for concurrent ownership and accountability. Therefore the NR provides a clear structure defining the roles and responsibilities along with a sustainable system for

constant mainstreaming of priorities and actions. More specifically, NR proposes an establishment of a network for the secondary cities to enable them to exchange knowledge on their successful practices.

The second foundation of urbanization is urban planning. It is an enabling platform for city leaders to drive constructive changes: a planned city is a prepared city that acknowledges and aligns development priorities; it facilitates impact through the developments of key urban growth characteristics (pillars and pull factors of this NR); it provides a greater level of continuous city affiliation, which can achieve increased provision of credibility; and it anticipates problems instead of dealing with them as they arise, providing a cost-effective solution for the city. To achieve a successful path of change, the NR identifies the need for improved availability of quality data so as to monitor and evaluate progress and performance.

The third foundation of successful urbanization is the compliance with safeguards. This enables the consideration of both environmental and social policies when planning for implementation.

Pillars of Urbanization

The foundations identified in this document enable efficient implementation of the urbanization pillars. In turn, the NR identifies green guidelines for each of the six pillars to successfully achieve sustainable green urbanization. This is particularly significant as the secondary cities face population growth and have to adopt mechanisms to efficiently absorb increased human activity.

There are large gains to be made within the building sector with regard to preserving and protecting the environment, and sustainable maintenance of buildings enables savings on future usage costs. Given that the building sector is the highest contributor to GHG emissions, implementing green guidelines on building production and usage is the most direct approach to reducing GHG emissions. The NR proposes the promotion of green building designs, the use of locally available sustainable materials for construction, and the diffusion of a local green building certification system.

The **energy** sector is the engine of city growth. Energy is needed in all dimensions of growth: the provision of electricity for in home use; the functioning of electrical

devices for the production or usage of means of communication; and for other crucial functions, such as treating water for drinking, and pumping water to specific locations. The current national challenges in the energy sector directly affect the development of the secondary cities and their path to green growth. Key parameters requiring consideration in order to meet the needs of cities' growth include the determination of energy sources, and parameters of energy supply, capacity, and efficiency. Green guidelines of the NR therefore touch upon the production and consumption of energy for sustainable growth. This includes the following: the national focus on acquiring further more sustainable energy sources from renewables for the main grid; the promotion of energy efficient lights; the encouragement of using off-grid renewable energy; and the sustainability of the consumption of wood as a source of energy.

The **urban mobility** sector is the connectivity platform for urban growth. Cities need an implemented road network for connectivity and a reliable and efficient public transport system. Efficient planning and management is needed due to the negative environmental implications to the use of land from the construction of roads and the high levels of congestion from using polluting means of transport. The NR thus proposes guidelines for efficient means of planning for the road network, public transport system and for enabling a walkable city. These measures serve to increase connectivity within the city, reduce the amount of polluting vehicles, and promote eco-friendly roads that enable cycling.

Water is a necessity for human survival and therefore is a necessity for urban growth. Whether it is for drinking it for washing measures, for growing crops or for the industrial production of goods and services, it needs to be readily in supply and there is a need to have a system in place that allows for its increased access. As urbanization increases along with household connectivity, water consumption will exponentially increase; consumer behavior will add pressure to the provision of water. Increased demand imposes environmental pressure on the water source and raises efficiency requirements for water treatment. The NR therefore proposes guidelines for the following: preserving and protecting water sources; ensuring access to improved water; improving the sustainability of water treatment; improving the efficiency of the water distribution system; and optimize water consumption behaviors.

As urbanization increases, human waste increases, therefore a need for a good sanitation system is evident. The increased demand for good sanitation systems in rapidly urbanizing cities requires that proper disposal measures be implemented to keep hygiene levels high and prevent disease outbreaks. There is potential for the recycling of the sludge for energy generation purposes, as agricultural fertilizer, or simply for decomposition in the soil. The two latter potentials are already common methods of disposal for small population sized areas, however a city will need to develop a large-scale system. This entails efficient measures for collection, disposal and processing. The NR therefore proposes the following guidelines for efficient waste processing: planning of a sanitation system; adoption of efficient collection technology; and implementation of a plan for the treatment, recycling or disposal of human waste.

Organic waste can be composted, which is a common disposal method. Non-organic waste however is damaging to the environment, as it does not decompose. Together, organic and non-organic waste, can be collected, separated and treated with the appropriate technologies, using eco friendly approaches similar to the management of human waste. Sustainable waste management is deemed more complex when dealing with a larger amount of waste, reflective of the greater population size of a city. In order to plan for efficient waste management measures, the NR proposes the following guidelines: the preparation and adoption of a waste management plan; the minimization of waste generation; the improvement of segregation of waste in middle and high-income areas; the improvement of waste collection in low-income areas or already formed informal settlements; the maximization of valorization of waste through composting, recycling and reusing; and the design of eco-friendly landfill sites.

Urbanization Pull-Factors

The EDPRS2 urbanization target of 35% requires a high urbanization rate in the secondary cities. City pull factors are necessary to attract potential urban dwellers such as providing the opportunity for a better quality of life, obtaining employment opportunities, and making public services accessible (from the pillars of the NR).

The ability of the secondary cities to create job opportunities increases the chances of a rural dweller moving to the urban area. With the efficient implementation of the green urbanization pillars, the

National Roadmap for Green Secondary City Development

local economy enables the direct creation of green jobs. In addition, with the multiplier effect there will be higher demands in other sectors, such as the services sector, which will create further general job opportunities. Each secondary city has its own economic development potentialities, enabling the implementation of further green initiatives and therefore creating a larger number of green jobs. The NR proposes strategies that positively influence urban pull-factors and thus accelerate the development of a green economy for the purpose of achieving green growth. Such strategies include: “implement local economic development strategies;; invest in the pillars of urbanization; plan the development of eco-industrial parks; support technical training for green industries; develop the green tourism industry; promote green technologies; support green entrepreneurship; and assure compliance of safeguards on green jobs.

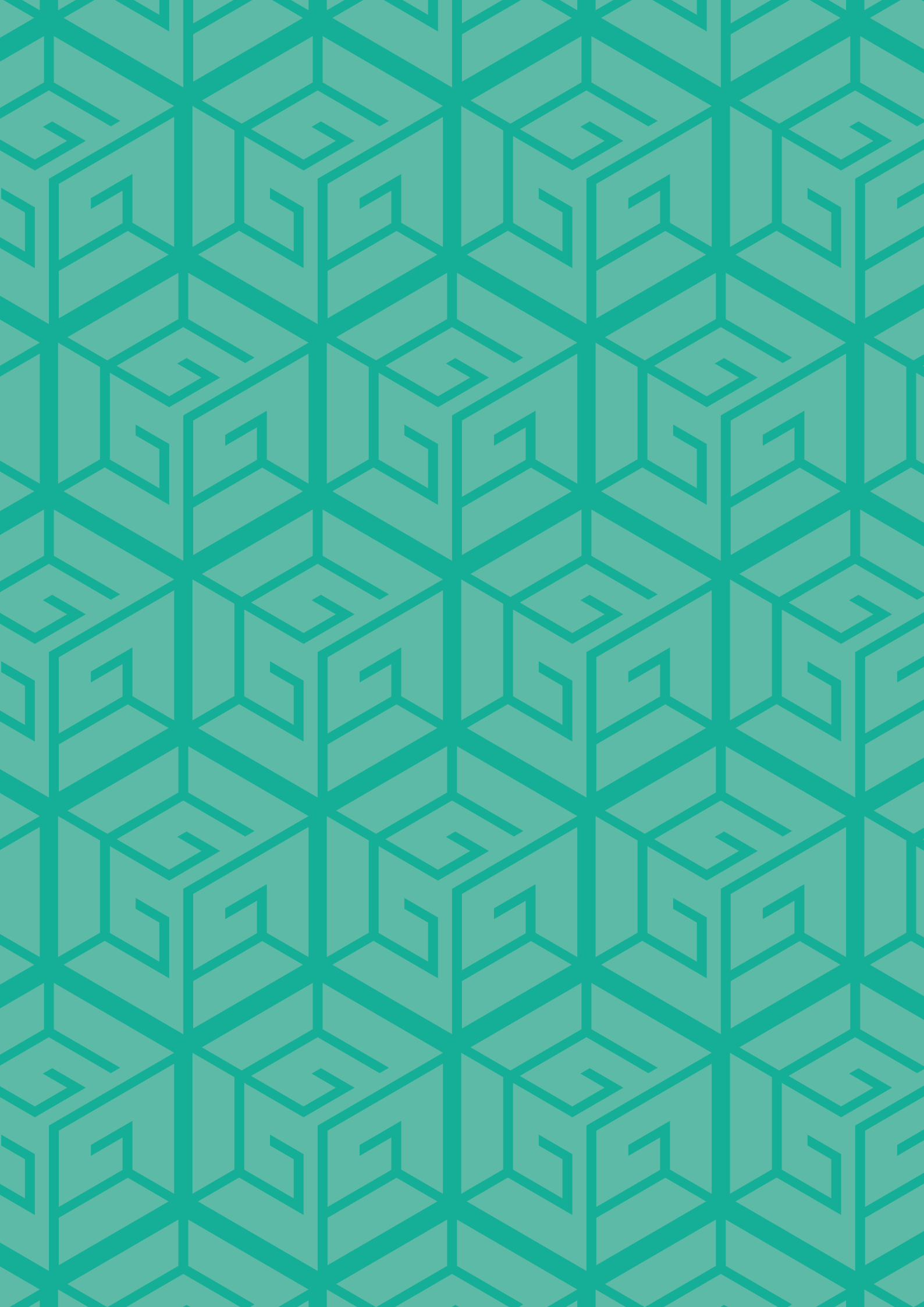
The availability of basic services in secondary cities, such as accessible quality education, health and infrastructure services, also serves as a pull-factor for urbanization. Considering the requirements of new urban residents, it is strategic to offer basic services which are socially inclusive and take into consideration the needs of low income segments of the population For example, supporting the establishments of Early Childhood and Family Development Centres in secondary cities will make the city a family friendly place.

Implementation of Guidelines and Strategies

The NR green guidelines are matched with proposed key tangible national and local actions. These have been formulated from extensive consultations and workshops with all key stakeholders including the national government, local secondary city government, agencies, development partners and the private sector.

Recommended actions set forth in the NR were developed to complement existing national and local action plans. To ensure the effective implementation of the actions set forth in the NR, each of the points of the plan has been linked to its appropriate institutional agency This is to also influence alignment, consistency and accountability of actions. Furthermore, the NR serves as a performance measurement tool, enabling the monitoring and evaluation process.

Branching off the NR, an Investment Strategy and a Capacity Building Program will be produced in order to help implement various proposed actions. They will serve to enable, attract and accelerate investments and expertise of the NR pillars in a sustainable fashion. This will be conducted through direct collaborations with the Government of Rwanda, development partners and the private sector.



Incamake

Gahunda irambye yo guteza imbere imijyi yungirije Umujyi wa Kigali mu Rwanda, ni gahunda y'igenamigambi ry'imiturire n'imitunganyirize y' imijyi, ndeste n'iterambere ry'ubukungu bw'iyi mijyi yungirije umujyi wa Kigali, igamije guha umurongo ngendarwaho Leta y' U Rwanda mu bikorwa by'iterambere rirambye no kurwanya ubukene mu mijyi yungirije umurwa mukuru nk'uko yatoranijwe ari itandatu muri gahunda y'imbaturabukungu ya 2 (EDPRS 2). Iyi gahunda y'iterambere ry'imijyi yungirije umujyi wa Kigali, ijyanye kandi yuzuzanya n'ingamba z'Igihugu zo kubungabunga ibidukikije no guhangana n'imihindagurikire y'ibihe "National Strategy for Climate Change and Low Carbon Development". Mu cyerekezo cyayo cyo kugeza muri 2050, iyi gahunda yerekana ibikorwa bizageza kw'iterambere rirambye ry' u Rwanda mu guhangana n'ibibazo by'imihindagurikire y'ibihe.

Iyi ni gahunga y'Iterambere ry'imijyi yibanda ku mijyi itandatu yungirije umujyi wa Kigali, ni gahunda y'Igihugu ihuriweho n'abandi bafatanyaga bikorwa nka Banki y'Isi na UNHABITAT. Iyi Gahunda, yateguwe n'itsinda ry'impuguke mw'iterambere rirambye ry'Imijyi rya Global Green Growth Institute (GGGI) rikorera I Kigali, mu Rwanda ku bufatanye n'abakozi ba Minisiteri y'Ibikorwa Remezo (MININFRA). Imitegurire y'iyi gahunda kandi yakurikiranywe na komite igizwe na Minisiteri zinyuranye ndeste nibindi bigo bya Leta bifite mu nshingano gukurikirana iterambere rirambye ry'imijyi yungirije umujyi wa Kigali. Mu kwezi kwa Nyakanga, 2015 nibwo iryo tsinda ry'inzobere ryakoze ingendo muri buri mujyi wungirije umujyi wa Kigali rigirana inama nyungurana bitekerezo n'abayobozi, abatekinisiye ndetse n'abafatanyaga bikorwa muri buri Karere.

Ingingo z'ingenzi zakoreshejwe mu gutegura iyi gahunda ni izi zikurikira:

- Gufasha gushyira mu bikorwa gahunda y'Imbatura bukungu (EDPRS 2) na gahunda y' Igihugu yo kubungabunga ibidukikije no kurwanya imihindagurikire y'ibihe (**National Strategy for Climate Change and Low Carbon Development**).
- Guhuriza hamwe ibikorwa ku rwego rw'igihugu n'inshingano zigendana n'iyi gahunga y' Iterambere

ry'imijyi hibandwa ku mijyi itandatu yungirije umujyi wa Kigali.

- Kugaragaza imirongo ngenderwaho ya gahunda y'iterambere rirambye ry'imijyi itandatu yungirije umujyi wa Kigali hibandwa ku bikorwa remezo.
- Gutanga icyerekezo kijyanye no guhanga imirimo no kurwanya ubukene.

Akamaro ka gahunga y'Iterambere ry'imijyi yungirije umujyi wa Kigali mw'iterambere rusange:

Ikigero cy'abatuye mu mijyi mu Rwanda kiracyari gito (17.3%) ugereranije n'ibindi bihugu byo muri Afurika, ariko ikigereranyo cyo kwiyongera kw'abaturage bo mu mijyi cyo kirazamuka cyane ubu kigeze kuri 4.5% kirenga kure cyane ikigereranyo ku rwego rw' isi kibarirwa kuri 1.8%. Ahanini abaturage biyongera cyane mu mujyi mukuru wa Kigali kugeza ubu ufite ubwiyongere bw'abaturage bungana na 9% ku mwaka. Kugirango iterambere ry'ubukungu rigendane no kwiyongera kw'abaturage n'ubutaka igihugu gifite, iterambere ry'imijyi rigomba kugera kuri 35% nibura muri 2020, kubera iyo mpamvu leta y'u Rwanda yahisemo imijyi itandatu izaba nk'ishingiro ry'iryiterambere ry'ubukungu cyane cyane ishora mari ry'ibikorwa remezo rizibanda kuri iyi mijyi.

Iyo urebye iyi mijyi itandatu ariyo Huye, Muhanga, Rubavu, Musanze, Nyagatare na Rusizi nayo ni mito ntago ifite ubushobozi bwo kwakira kwiyongera kw'inshi kw'abaturage bayo niyo mpamvu bisaba gucunga neza uburyo ibikorwa remezo by'ibanze bizubakwa. Leta y' u Rwanda yifuje kandi ko iri terambere ry'imijyi n'ubukungu rigengwa n'amahame y' iterambere rirambye hafatwa neza imitungo kamere n'ibidukikije, ibi bikazafasha mu mpiduka z'ubukungu bw'igihungu muri rusange.

Ihuriro hagati y'iterambere ry'imijyi n'iterambere ry'ubukubungu rirambye

Iterambere ry'umujyi n'inkingi ikomeye mu gutera imbere kw'igihugu, imijyi iyo ifite amahirwe menshi yo guteza imbere ubukungu bizamura ubukungu bw'abatuye mu mijyi bikanabafasha ubuhahirane. Ariko ku rundi ruhande gukura kw'imijyi bishobora kuba ikibazo ku buzima kw'abayituye, mu gihe bitwara umutungo kamere n'ibidukikije, byongerera imyanda mu kirere n'imyanda ituruka mu bantu n'ibintu. Dukurikije impinduka zo gukura kw'imijyi bigira ku bidukikije, usanga hagaragara ingaruka zifatika kw'iterambere rirambye ry'igihugu muri rusange, ariko hari n'ingamba zafatwa zigafasha mu kugabanya kwanduza ikirera guterwa n'ibikorwa by'abantu, ndeste zikanafasha guteza imbere imibereho myiza y'abaturage batuye muri iyo mijyi bikanihutisha iterambere ry'ubukungu ry'iyi mijyi.

U Rwanda rufite ubushake ndeste n'ubushobozi bwo kurenga imitego n'amakosa yaterwa n'iterambere ry'imijyi ryihuse. Igenamigambi ry'iterambere rirambye kw'iyi mijyi yungirije umujyi wa Kigali rizafasha mu gukumira ibibazo byaterwa no kwiyongera kw'abaturage, bizakemura kandi ikibazo cy'imiturire mibi kigendana no kubura kw'ibikorwa remezo by'ibanze.

Uburyo bwo kujyanirahamwe ibikenewe mw'iterambere ry'imijyi

Iterambere ry'imijyi rikubiyemo ibintu byinshi, ibi bituma ingamba zo kugabanya uruhare rw'ibikorwa by'abantu mu kwangiza ibidukikije n'umutungo kamere zibanda cyane ku nkingi zose zibanze zifite uruhare mu gukura kw'imijyi kugirango hatagira igisigara inyuma muri Gahunda y'iterambere rirambye ry'Imijyi itandatu yungirije umujyi Kigali byashyizwe mu byiciro bitatu by'ingenzi:

- Imisingi: Imiyoborere myiza, igenamigambi ry'imijyi, no guteza imbere imibereho myiza y'abaturage harengerwa n'ibidukikije.
- Inkingi: imyubakire, ingufu, imigenderanire, amazi, isuku n'isukura, n'Imicungire y'Imyanda.

- Ibikorwa bikurura abantu mu mijyi: Iterambere ry'ubukungu, guhanga imirimo, n'imibereho myiza mu rwego rwo kugera kw'iterambere rirambye mu mijyi yose yungirije umujyi wa Kigali no kugirango imirimo ya ngombwa igendere hamwe, iyi gahunda yerekana ibikorwa by'ingenzi kuri buri cyiciro (Imisingi, inkingi, Ibikorwa bikurura abantu mu mijyi) ikanatanga imirongo ngenderwaho kuri buri nkingi y'iterambere ry'imijyi.

Imisingi y'iterambere ry'imijyi

Imisingi y'iterambere ry'imijyi ni urufatiro rw'iterambere rirambye. Iyi misingi ititaweho ntabwo iryo terambere ryashoboka cyangwa ngo ryubahirize imibereho myiza y'abaturage b'iyi mijyi

Umusingi wa mbere ni Imiyoborere myiza: Hagaragazwa ingamba zigera kuri enye zibanda cyane ku miyoborere myiza muri iyi gahunda harimo: Inshingano z'uturere uko ari dutandatu, Gushaka ubushobozi bwo kongera ishoramari mu turere, Gushyiraho gahunda z'ingendo shuri mu rwego rwo kungurana ubumenyi mu turere, no kubaka ubushobozi ngiro mu bayobozi n'abatekinisiye b'uturere.

Umusingi wa kabiri ni ugushyiraho gahunda iboneye y'igenamigambi ry'iterambere ry'imijyi: Hagaragazwa ingamba zo gukora no gutanga neza imibare ifasha igenamigambi, kwerekana ahantu hatezwa imbere, kubungabunga ibidukikije bishobora kwangizwa no kwaguka kw'imijyi, guteza imbere imiturire yegeranye kandi ihuriweho n'abantu bose, guhuza iterambere ry'imijyi n'iterambere ry'ibikorwa remezo rirambye, guteganya ubusitani buhagije mu mijyi iri kubakwa, kubahiriza ihame ry'uburinganire mw'iterambere ry'imijyi, kubaka imijyi ihangana n'ibiza ndeste n'imihindagurikire y'ibihe;

Umusingi wa gatatu ujyanye no gushyiraho gahunda zo kuzamura imibereho myiza y'abaturage no kurengera ibidukikije. Izi ngamba zo guteza imbere imijyi yungirije umujyi wa Kigali zijyanye na gahunda, politike ndetse n'ibikorwa bya GGGI, bikibanda cyane ku ikumirwa n'ikemurwa ry'ibibazo biterwa no kwimura abaturage mu gihe cy'ishyirwa mu bikorwa ry'imishinga y'ibikorwa remezo.

Inkingi z'Iterambere rirambye ry'imijyi

Iterambere rirambye ry'imijyi rishingira ku nkingi zikomere nk'imyubakire y'ibikorwa remezo n'amazu bigendanye n'ubwiyongere bw'abaturage ndeste n'ubukungu. Kubw'iyi mpamvu gahunda y' Iterambere ry'imijyi itandatu yungirije umujyi wa Kigali igaragaza imirongo ngenderwaho kuri buri nkingi y'iterambere ry'umujyi rirambye.

Inyubako

Imyubakire igira uruhare mu kohereza imyuka yanduzwa ikirere n' uruhare runini mu kwangiriza ibidukikije n'umutungo kamere kubera ibikoresho by'ubwubasti bikenerwa. Imirongo ngenderwaho iyi gahunga y'Iterambere ry'imijyi itandatu yungirije umujyi wa Kigali yibanda cyane kuguteza imbere ibikoresho by'ubwubasti byo muri utu turere, yibanda kandi kugushyiraho uburyo bwo kwemeza inyubako zujuje ubuziranenge n'ibyangombwa by'inyubako zubatswe muburyo bunoze butabangamiye ibidukikije cyangwa ngo hasesagurwe umutungo kamere.

Ingufu

Ingufu n'inkingi ikomeye y'iterambere ry'imijyi rirambye no guteza imbere ubukungu. Ibibazo bigaragara mu gukwirakwiza ingufu bigira uruhare runini mw'iterambere ry'imijyi itandatu yungirije umujyi wa Kigali. Ingufu zigira uruhari mu guteza imbere inganda zitanga amazi meza, zimurikira imihanda, zituma iminara y'itumanaho ikora neze bigafasha mu gutanga ubutumwa byihuse.

Hari kandi n'Ingufu zituruka ku ibimera n'amatungo (Biomass) zifasha cyane ingo z'abaturage mu guteka. Ku bijyanye n'inkingi y'ingufu gahunda y' Iterambere ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo ngenderwaho zigera kuri enye zijyanye no gutunganya no gukwirakwiza ingufu:

- Ingingo yambere irebana no gushyiraho no guteza imbere ingufu zisubiranywa (renewable energy) kugirango zunganire mu gukwirakwiza ingufu.
- Ingingo ya kabiri itanga ingamba zo gushyira uburyo bwo gucana amashanyarazi bugezweho kandi burambye mu mazu ahuriramo abantu benshi ndeste no gucanira mihanda.
- Ingingo ya gatatu ijyanye no kugabanya no gushyiraho uburyo bwihariye bwo gusakaza ingufu

z'amashanyarazi mu mijyi itandatu yungirije umujyi wa Kigali kugirango bigabanye ubwinshi k'umuyoboro umwe w'amashanyarazi.

- Ingingo ya kane ni guteza imbere gukoresha ingufu zituruka ku ibimera n'amatungo (Biomass).

Imigenderanire

Imigenderanire mu mijyi ifite uruhare runini mu gukwirakwiza imyuka yanduzwa ikirere. Gushyiraho uburyo bwo guteza imbere imigenderanire butabangamira ibidukikije bizafasha cyane mu kubungabunga ibidukikije biri mu mijyi. Gahunga y'Iterambere ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo ngenderwaho kuri iyi nkingi irebana cyane no:

- Kujyanisha hamwe igenamigambi ry'iterabere ry'imijyi n'iry'imihanda,
- Gukorera abanyamaguru aho bagendera hihariye,
- Gukora igenamigambi ry'ubwikorezi rusange mu mijyi (public transport)
- Gushyiraho inzego zijyanye n'uburyo bw'imyubakire y'imihanda ibi bikazafasha mu guteza imbere ishoramari mu myubakire y'imihanda.

Amazi

Gukora no gukwirakwiza amazi meza n'imwe mu nkingi z'iterambere ry'umujyi. Amazi meza ni kimwe mu bikenerwa by'ibanze kugirano umuntu agire ubuzima bwiza. Amazi kandi ni ngombwa cyane mu mijyi iri gukura cyane mu bukungu. Ku bijyanye n'amazi gahunga y' Iterambere ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo ngenderwaho ishanu zikurikira:

- Kubungabunga amasoko y'amazi meza
- Kugeza amazi kubatuye imijyi bose
- Kongera ubushobozi bwo gutunganya amazi
- Kongera ubushobozi bwo gukwirakwiza amazi ndeste no
- Gushyiraho uburyo bufasha kongera ifatabuguzi ry'abaturage

Isuku n'isukura

Uko imijyi igenda ikura n'abaturage biyongera ikibazo cy'amazi yanduye kigenda kigorana. Iyo abaturage batuye bategeranye gukora isuku n'isukura biroroha buri rugo rugira umusarani warwo, ariko ibibazo bivuka cyane cyane ahantu abantu benshi bahurira icyo gihe bisaba ko haba harashyizweho uburyo rusange bwo gukusanyiriza hamwe imyanda yose ikaba yabyazwa umusaruro. Kuri iyi nkingi gahunga y'iterambere ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo ngenderwaho zikurikira:

- Gukora igenamigambi y'uburyo bugezweho bwo gukusanyiriza hamwe amazi yanduye (Sanitation Master Plan) hakurikijwe imijyi uko iteye
- Gukora igenamigambi ryo kubyaza umusaruro imyanda cyane cyane nko mu buhinzi.

Imicungire y'Imyanda

Imijyi uko ikura mu baturage n'inganda nyinshi imyanda iriyongera. Imyanda myinshi yo mu mijyi itandatu yungirije umujyi wa Kigali urebye ahanini ni imyanda ishobora kubora, ariko uko ingo z'abaturage ziyongera niko imyanda yiyongera ikabonekamo ni itabasha kubora (palasitike, ibyuma, mudasobwa zishaje, n'ibindi) niyo mpambu igenamigambi rirambye ryibanda ku kubyaza umusaruro n'amicungire y'imyanda mu mijyi itandatu yungirije umujyi wa Kigali rikenewe kugirango bigendane no gukura kw'imijyi. Gahunga y'iterambere ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo esheshatu ngenderwaho zikurikira:

- Gutegura igenamigambi rigendanye n'amicungire y'imyanda mu mijyi
- Gushyiraho ingamba zo kugabanya imyanda mu mijyi
- Gushyiraho gahunda yo gutwara no gutandukanyiriza imyanda aho abantu batuye bitewe n'ubushobozi bw'abahatuye
- Gufasha imicungire y'imyanda mu duce tumwe aho ubushobozi bw'abaturage ari buke
- Gufasha imicungire y'imyanda mu duce dufite imiturire mibi
- Guteza imbere gahunda zo kubyaza umusaruro imyanda

Ibikorwa bikurura abaturage mu mijyi (Strategic Pull factors)

Leta y' u Rwanda yashyizeho ikigerereny cyo kwongera imijyi kiri hejuru niyo mpamvu hagomba gufatwa ingamba zo gukangurira abaturage bo mu cyaro kuza gutura mu mijyi itandatu yungirije umujyi wa Kigali, ahanini biterwa n'ubushake bw'umuturage ku giti cye cyangwa bw'ingo zishaka kubona ibyangombwa bizamura imibereho yabo myiza. Kugirango imibereho myiza itere imbere bisaba ahanini ibi bikurikira:

- Kubona akazi kishyura neza
- Gugezwaho serivisi z'ibanze z'ibikorwa remezo rusange

Guhanga imirimo n'iterambere ry'ubukungu mu mijyi itandatu yungirije umujyi wa Kigali nizo ngamba zangombwa zakurura abaturage gutura muri iyi mijyi bavuye mu cyaro.

Igikorwa cy'ibanze gishobora gutuma abantu baza mu mijyi ni ukuhabona akazi kabishyura neza, ibyo haricyo leta yabigiramo uruhare. Urugero nko guhanga imirimo ijyanye n'ubukungu burambye mu ngufu zisubiranye, kwubaka ibikorwa remezo birambye, inyubako zirambye, ubukerarugendo buharanira kubungabunga ibidukikije, n'ubuhinzi burambye. Gahunga y'iterambere ry'ubukungu rirambye ry'imijyi itandatu yungirije umujyi wa Kigali itanga ingingo ngenderwaho umunani zikurikira:

- Gushyiraho ingamba z'iterambere ry'ubukungu,
- Gushora imari mu bikorwa remezo,
- Gukora igenamigambi rijyanye no gushyiraho inganda zibungabunga ibidukikije (Eco-industries)
- Guteza imbere amashuri y'imyuga mu bikorwa biteza imbere ubukundu burambye
- Guteza imbere iterambere rirambye rishingiye kw'ihame ry'uburinganire bw'umugabo n'umugore
- Guteza imbere ikoranabuhanga rirambye
- Gufasha abikorera ku giti cyabo bafite imishinga mu guteza imbere ubukungu burambye
- Gushishikariza kubahirizwa kw'amategeko na politike zo kubungabunga imibereho myiza y'abakozi zashyizweho mu kubahiriza inshyirwa mu bikorwa rya gahunda z'akazi karambye

Sommaire exécutif

La National Roadmap for Green City Development (NR) est un document de planification territoriale et économique visant à guider les interventions du Gouvernement du Rwanda en vue du développement de six villes secondaires préalablement identifiées à EDPRS 2, la Seconde Stratégie de développement économique et de réduction de la pauvreté. Parallèlement, la NR constitue un outil opérationnel de la National Strategy for Climate Change and Low Carbon Development. Par sa vision et ses actions, cette stratégie trace la voie au développement d'un pays résilient face aux changements climatiques, caractérisé par de faibles émissions de carbone en 2050. La NR a été élaborée par une équipe d'experts en développement urbain durable du Global Green Growth Institute (GGGI) basée à Kigali, en collaboration avec les professionnels du Ministère des infrastructures (MININFRA) de la République du Rwanda. Les travaux étaient encadrés par un comité de direction formé de représentants des ministères et agences concernés par le développement des villes secondaires. De plus, l'élaboration de la NR s'appuie sur un processus local de consultation mené auprès des administrations locales en juillet 2015. La préparation de la NR s'inscrit dans un programme d'action plus large du Ministère des infrastructures qui vise le développement des villes secondaires, programme auquel collabore aussi la Banque Mondiale ainsi que UN-Habitat. Les quatre principes directeurs qui ont guidé l'élaboration de la NR sont les suivants :

- La NR constitue un outil de mise en oeuvre d'EDPRS 2 et de la National Strategy for Climate Change and Low Carbon Development.
- La NR offre un cadre d'action au niveau national identifiant les rôles et responsabilités pour le développement des six villes secondaires.
- La NR guide le processus d'urbanisation et le développement des infrastructures dans le cadre d'une croissance verte et durable.
- La NR offre une vision intégrée pour la création d'emplois et la réduction de la pauvreté.

L'importance des villes secondaires pour la croissance

Le taux d'urbanisation du Rwanda est d'environ 18%, ce qui est l'un des plus faibles du continent africain. Toutefois, le taux de croissance actuel de la population urbaine est de 4.5%, ce qui dépasse largement la moyenne mondiale établie à 1.8%. Par ailleurs, cette forte croissance urbaine est aujourd'hui largement concentrée dans la capitale et première ville du pays, Kigali (taux de croissance démographique annuel de 9%). En vue de mieux répartir la croissance économique et démographique à travers le territoire national et d'atteindre un taux d'urbanisation de 35% d'ici l'année 2020, le Gouvernement du Rwanda a identifié six villes secondaires qui constitueront des pôles de croissance. Ces six villes feront l'objet d'une attention particulière au cours des prochaines années et concentreront une partie de l'investissement public en infrastructures. De taille relativement limitée, les villes secondaires de Huye, Muhanga, Nyagatare, Rubavu, Musanze et Rusizi sont appelées à accueillir une croissance démographique importante, ce qui pose des défis de gestion et de provision des infrastructures et services de base. Parallèlement, en plus de répondre à une volonté nationale de créer des pôles de croissance secondaires, le Gouvernement du Rwanda souhaite profiter des retombées de l'urbanisation afin d'accélérer la transformation économique du pays et son passage vers une économie verte.

Le lien stratégique entre l'urbanisation et la croissance verte

Le développement urbain est stratégique pour une nation. Les villes concentrent les opportunités économiques, proposent un environnement fertile à la création de richesse et favorisent l'échange des idées. Toutefois, les villes sont consommatrices de ressources, génèrent de la pollution et des déchets, et concentrent les secteurs d'activité émettant des gaz à effet de serre. À cet effet, l'urbanisation constitue un défi important de l'humanité. Considérant l'impact environnemental des villes, ces dernières offrent par ailleurs une échelle d'intervention permettant une action directe et tangible

qui a un impact direct sur le niveau de durabilité d'une nation. Notamment, en intervenant sur les composantes stratégiques du phénomène de l'urbanisation, il est possible de diminuer la pollution engendrée par les activités humaines, améliorer la qualité de vie des citoyens, et accélérer la croissance économique. Le Rwanda a la volonté et la capacité d'éviter les pièges d'une urbanisation rapide. La planification de la croissance des villes secondaires dans un cadre durable permettra d'anticiper les nuisances liées à la concentration de la population et de mieux répondre aux défis liés à l'habitat informel et à la desserte en infrastructures.

Une approche transversale de l'urbanisation

L'urbanisation est un phénomène complexe et multidisciplinaire. À ce titre, les actions visant à diminuer l'empreinte des activités humaines doivent toucher aux secteurs caractérisant la croissance urbaine. Afin de permettre la mise en place d'un cadre d'intervention cohérent et adéquat, le phénomène d'urbanisation a été divisé dans le cadre de la NR en trois grands ensembles :

- les fondements : la bonne gouvernance, la planification urbaine, et les politiques de sauvegarde sociale et environnementale;
- les piliers : le secteur du bâtiment, l'énergie, la mobilité urbaine, la production et la distribution d'eau, l'assainissement des eaux usées, et la gestion des déchets;
- les facteurs attractifs : le développement économique et la création d'emplois, la qualité de vie.

Afin d'orienter la croissance durable des villes secondaires et d'assurer la cohérence des interventions de l'État, la NR propose des stratégies guidant les fondements et les facteurs attractifs de l'urbanisation, ainsi que des lignes directrices pour chacun des piliers de la croissance urbaine.

Les fondements de l'urbanisation

Les fondements de l'urbanisation sont les bases d'un processus de croissance durable. Sans une prise en compte de ces derniers, le développement urbain s'effectue de façon non-organisée, voir anarchique, et ce en dépit de la qualité de vie des citoyens. Le premier fondement de l'urbanisation est la bonne gouvernance. Dans le cadre du projet de développement des villes secondaires, quatre stratégies visent spécifiquement la bonne gouvernance, soit la définition des rôles et responsabilités des districts, l'identification de nouvelles sources de revenus, la mise en place d'un cadre d'échange des bonnes pratiques, ainsi que le développement des expertises et capacités des techniciens et élus locaux. Le second fondement de l'urbanisation durable est la mise en place d'un cadre adéquat de planification urbaine. Les stratégies proposées par la NR visent à améliorer la qualité des données statistiques disponibles, à anticiper les besoins en espaces développables, à préserver les écosystèmes susceptibles d'être affectés par l'urbanisation, à promouvoir la densification et la mixité des usages, à lier le développement urbain à celui des transports durables, à intégrer suffisamment d'espaces verts dans les villes, à favoriser la création de villes égalitaires pour les femmes et les hommes, et à assurer le développement de villes résilientes et aptes à faire face aux changements climatiques ainsi qu'aux catastrophes. Le troisième fondement de la croissance urbaine verte est l'application de politiques de sauvegarde sociale et environnementale. Les stratégies liées aux politiques de sauvegardes proposées dans la NR s'inscrivent dans les politiques d'intervention de GGFI. Une considération spécifique est énoncée en ce qui a trait à la relocalisation des populations dans le cadre de projet d'infrastructures.

Les piliers de la croissance urbaine

La croissance urbaine durable doit être basée sur des fondations solides, mais nécessite aussi la construction de bâtiments et d'infrastructures aptes à supporter l'expansion démographique et économique. À ce titre, la NR identifie des lignes directrices pour les six piliers de l'urbanisation durable. Le secteur du bâtiment a un impact

majeur en termes d'émission de gaz à effet de serre. Par ailleurs, il est aussi un grand consommateur de ressources par les matériaux utilisés pour la construction. À cet effet, les lignes directrices proposées par la NR visent à promouvoir la construction de bâtiments verts, à favoriser l'utilisation de matériaux locaux pour la construction, et à développer un système rwandais de certification des bâtiments durables. Le secteur de l'énergie est un pilier de l'urbanisation et un moteur de la croissance. Les défis actuels liés au secteur de l'énergie affectent directement le développement des villes secondaires. En milieu urbain, l'électricité permet l'éclairage des rues et permet le fonctionnement des machines liées à l'industrialisation et à la production d'eau potable. De même, l'électricité permet de faire fonctionner les moyens de communication qui soutiennent les interactions et les échanges. Par ailleurs, l'utilisation de l'énergie provenant de la biomasse permet quant à elle aux ménages de cuire la nourriture. En ce qui a trait à l'énergie, la NR propose quatre lignes directrices visant la production et la consommation de l'énergie. Premièrement, la NR vise la mise en place de sources d'énergie renouvelables pour alimenter le réseau principal de distribution. De même, la NR propose comme second principe directeur d'installer des systèmes d'éclairage intelligent et durable pour les bâtiments publics et le réseau routier. Troisièmement, afin de diminuer la pression sur le réseau principal de distribution d'électricité, la NR propose de développer des sources hors-réseau et autonomes pour alimenter les villes secondaires. Finalement, la NR suggère de promouvoir une consommation durable de l'énergie issue de la biomasse. En ce qui a trait à la mobilité urbaine, ce secteur est un grand générateur de carbone et une gestion durable des déplacements peut avoir un impact significatif sur l'empreinte écologique d'une ville. À ce titre, la NR propose comme ligne directrice pour ce pilier de l'urbanisation verte de lier la planification urbaine et la planification des transports, d'aménager la ville pour les piétons, d'envisager et de planifier la mise en place de réseaux de transport collectif, et de hiérarchiser le réseau routier afin de prioriser les investissements. La production et la distribution d'eau potable sont stratégiques pour la croissance urbaine. L'approvisionnement en eau constitue un besoin vital de l'être humain et est aussi essentiel pour supporter la croissance économique. À titre de pilier stratégique de l'urbanisation, les bonnes pratiques en matière de gestion de l'eau potable sont essentielles. La NR propose cinq lignes directrices pour la production et la distribution de l'eau : protéger les sources d'eau potable, assurer l'accès pour tous les citoyens, améliorer la durabilité des processus de traitement de

l'eau, améliorer l'efficacité du système de distribution, et optimiser la consommation d'eau des résidents. À mesure que la densité et la population d'une ville augmentent, la question de l'assainissement des eaux usées devient critique. Notamment, lorsque la population urbaine est de faible taille et dispersée la gestion des boues s'effectue aisément par l'entremise de systèmes individuels tels des latrines. Toutefois, lorsque le nombre de personnes situées en un même lieu augmente, l'implantation de systèmes collectifs de collecte et de traitement devient requise. Pour les questions d'assainissement, la NR propose les lignes directrices suivantes : favoriser la planification d'un système plutôt que celle d'un ensemble de mini-réseaux, sélectionner la technologie d'assainissement en fonction du contexte urbain, planifier le traitement et la réutilisation des boues, notamment à titre de fertilisant agricole. Les villes produisent des déchets et la gestion de ces derniers est stratégique pour une urbanisation durable. Dans le contexte actuel, les déchets produits par les citoyens et les industries des villes secondaires sont dans une très grande majorité de nature organique. Les déchets organiques peuvent, par leur nature, être plus facilement gérés dans le cadre d'un processus de décomposition. Toutefois, l'augmentation de la richesse des ménages entraîne une transformation de la nature des déchets et une augmentation de la proportion d'éléments non-organiques (plastiques, éléments électroniques, etc.). À cet effet, une planification à long terme prévoyant une transformation de la consommation des ménages est essentielle pour une ville en croissance. La NR propose six lignes directrices pour la gestion des déchets : la nécessité de préparer et adopter un plan de gestion des matières résiduelles, la mise en place de mesures favorisant la diminution de la génération de déchets, l'amélioration des pratiques de tri dans les quartiers à revenu moyen ou élevé, l'amélioration des pratiques de collecte dans les quartiers à bas revenu ou les zones d'habitat informel, l'amélioration des pratiques de valorisation des déchets (compostage, recyclage, réutilisation), et le design de décharges vertes et efficaces.

Les facteurs attractifs de l'urbanisation

L'objectif d'urbanisation du Gouvernement du Rwanda est ambitieux et nécessite une forte migration des populations rurales vers les six villes secondaires. L'attraction de citoyens vers la ville, le phénomène d'urbanisation, s'explique généralement par une

volonté des individus et des ménages d'améliorer leurs conditions de vie. Cette amélioration des conditions de vie passe principalement par deux facteurs attractifs: l'obtention d'un emploi rémunérateur et la possibilité d'utiliser des services publics. La création d'emploi et le développement économique local sont stratégiques pour attirer des migrants ruraux vers les villes. Principal facteur d'attraction des populations, la disponibilité d'emplois rémunérés constitue un élément sur lequel un État peut agir directement. Par ailleurs, la création d'emplois peut s'inscrire dans le contexte du développement d'une économie verte, notamment dans les secteurs des énergies renouvelables, des infrastructures vertes, de la fabrication écologique, du bâtiment durable, du tourisme vert, et de l'agriculture durable. La NR propose huit stratégies afin d'accélérer la croissance de l'économie verte, promouvoir la création d'emplois, et conséquemment d'attirer les migrants ruraux vers les villes secondaires : mettre en oeuvre les stratégies locales de développement économique, investir dans les infrastructures, planifier le développement de parc écoindustriels, supporter la formation technique dans les secteurs stratégiques de l'économie verte, promouvoir le développement d'une économie verte égalitaire entre les hommes et les femmes, promouvoir les technologies durables, supporter l'entrepreneuriat vert, et assurer le respect de politiques de sauvegardes sociales strictes en matière d'emplois verts. En plus de la disponibilité d'emplois, l'offre en services de bases dans les villes secondaires constitue un facteur attractif pour l'urbanisation. À cet effet, il est stratégique d'offrir des services de base accessibles et abordables pour assurer l'éducation des enfants et les services de santé. Par ailleurs, la disponibilité de services destinés aux parents et à la petite enfance, notamment par l'entremise de la création de Centres de développement de la petite enfance et de la famille dans les villes secondaire, permettra de rendre la ville plus accueillante pour les familles.

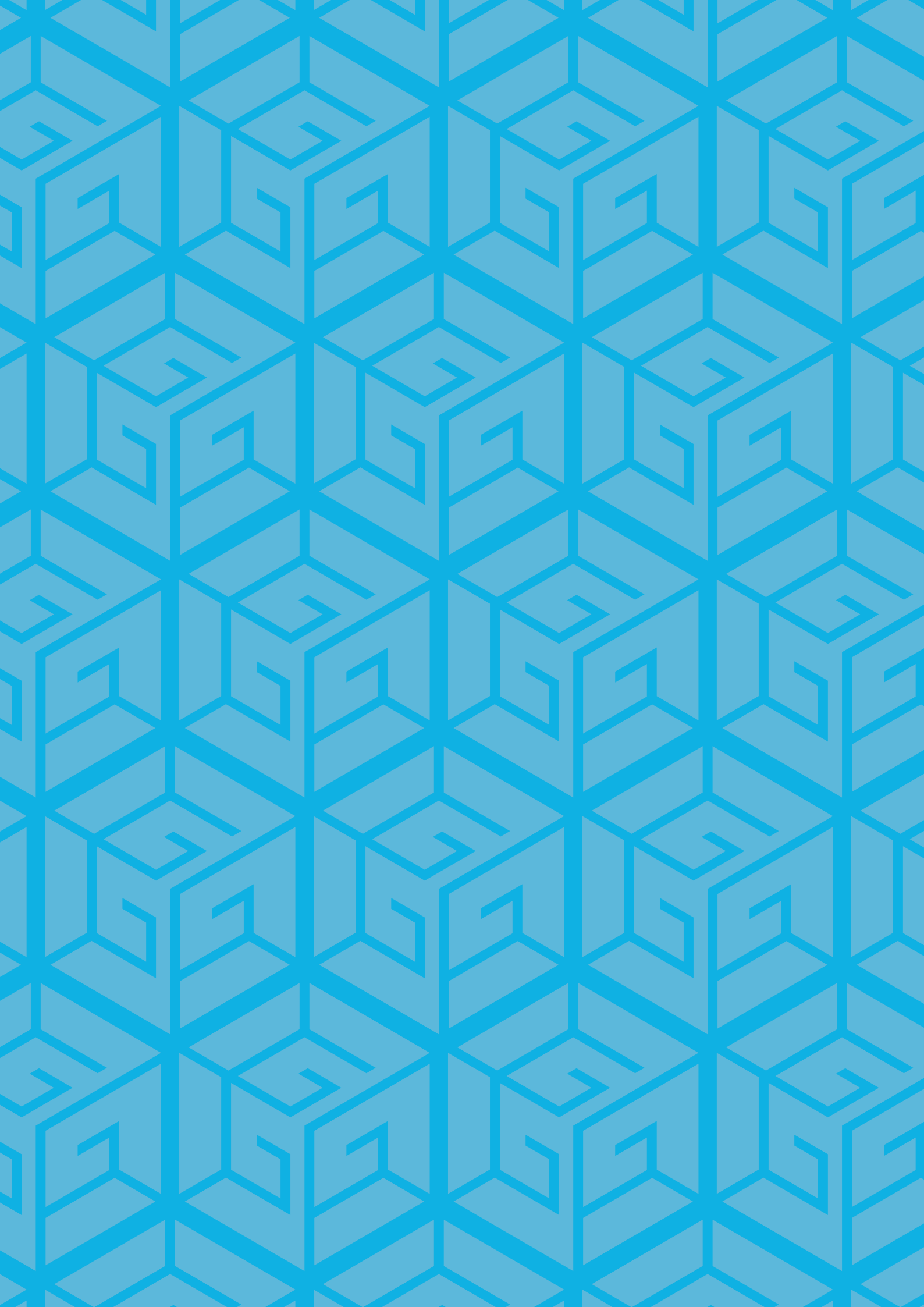
Un plan d'action national et local

La mise en oeuvre des stratégies et des lignes directrices exprimées dans la NR s'effectue par l'entremise d'actions locales (qui seront déployées par les districts) et d'actions nationales (qui seront mises en oeuvre par le Gouvernement du Rwanda par l'entremise de ses ministères et agences). En vue d'assurer la réalisation du plan d'action national et des plans d'action locaux

dans un cadre cohérent, chacune des actions est liée à un responsable de sa mise en oeuvre. La réalisation des actions et l'atteinte des objectifs seront mesurées dans le cadre d'un processus de contrôle et d'évaluation. À ce titre, la NR propose un outil de mesure de la performance.

La stratégie d'investissement et la mise en oeuvre

Outil opérationnel, la NR doit permettre l'attraction et l'accélération de l'investissement dans les infrastructures permettant une urbanisation durable. À cet effet, la préparation d'un plan d'investissement suivra l'adoption de la NR. Ce plan, élaboré en collaboration avec le Gouvernement du Rwanda, le secteur privé national et international, et les donateurs permettra la création d'infrastructures urbaines vertes dans les villes secondaires.



Key definitions

A common understanding of the terminology referred in this report is crucial. Different organizations, both within Rwanda and internationally, use different terminology and meanings, making it challenging to come to a common understanding of complex concepts. Therefore, in order to meet the objectives of the National Roadmap we need to define certain conceptual terms related to growth and green urbanization.

GROWTH

Growth is any economic activity that adds value to the economy by:

- Using factors of production (labor and capital) to add value to inputs to produce products and services for sale inside or outside Rwanda;
- Increasing productive capital (agricultural or industrial investment, etc.);
- Increasing human and social capital where there is a measurable improvement in productive potential (e.g. from improved health, education, etc.);
- Reducing environmental harm (e.g. reduced land degradation).

GREEN GROWTH

Green growth is a relatively new model of economic growth, and is defined as growth that is compatible with protecting the environment, reducing carbon and other unwanted emissions, improving the rational use of natural resources, dealing with climate change, securing access to clean energy and water, and simultaneously targeting poverty reduction, job creation and social inclusion.

Green growth in Rwanda is not only about introducing new aspects of greener technologies and industries that protect the environment whilst promoting development, it is also about looking at what is already implemented that is protecting and preserving the environment and enhancing development. Environmental and Social Impact Assessments as well as Resource Efficiency and Cleaner Production introduced into the country and are fundamental aspects of enabling green growth. The concept of green growth responds to the dual global challenges of expanding economic opportunities for a growing population; and mitigating the environmental pressures that

otherwise could undermine our ability to take advantage of these opportunities. This strategy recognizes that just as different countries follow different growth paths, advanced, emerging and developing countries will also need to pursue green growth differently. Each country's starting point and strategy for green growth will depend on its policies, institutions, levels of development, natural capital, and environmental vulnerabilities.

GREEN ECONOMY

Green Economy is the outcome of a successful Green Growth strategy. A Green Economy results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities; it is low carbon, resource efficient, and socially inclusive. A Green Economy is focused on growth that is friendly to the earth's ecosystems, but it must also contribute to broad developmental goals, in particular to poverty alleviation. It requires a transformation of production and consumption that enhances and preserves environmental quality, while using energy, water and natural resources more efficiently. Green economy therefore refers to industry and services that are greener than the business-as-usual approach would have been. This includes, but is not limited to: manufacturing of eco-friendly materials, resource efficiency and clean production process, renewable energy, pollution control, ecolabeling, waste management, environmental management, reforestation, organic farming and agriculture, water and sanitation control, provision of sustainable public transport, environmental friendly agro-processes and eco-tourism. In general, green economy comprises the re-design of products and processes, substituting conventional inputs for green inputs, recycling and reuse in internal production processes, use of cleaner technologies

and production processes with greater water and energy efficiency, and the redesign of transport and infrastructure systems, with all of this oriented to formal job creation, enhanced livelihoods and a reduction in poverty. In practice, green economy is any industry, service or investments in the agriculture, energy, manufacturing, transport, water or any other economic sectors that is contributing with lower energy consumption, GHG emissions, resource consumption and less pollution to poverty-reducing economic growth. It should be noted that achieving a green economy vision is not necessarily more costly overall than a business-as-usual approach, although individual investments may have a higher financial cost.

Green economy takes a holistic, long-term view, balancing immediate growth imperatives with concerns about intergenerational equity. Upfront costs therefore need to be weighed in this context, which implies that a low social discount rate needs to be used when evaluating investments.

GREEN JOBS

Green jobs are jobs provided by businesses that recognize environmental protection as a driver of global and national economic development. However, a job can be considered green when it contributes to environmental improvement more than an equivalent business-as-usual job. This could also include any jobs in productive industry where the job holder is simply diverted away from a previously environmentally destructive path (e.g. intensive farming that was degrading soil).

GREEN CITY

A green city is a city designed with consideration of environmental and ecological impact, inhabited by people dedicated to minimization of required inputs of energy, water, and waste output of heat, air pollution, and water pollution. A green city is inclusive and enhances the well-being of citizens and society through integrated urban planning and management, harnessing the benefits of ecological systems while protecting and nurturing them for future generations. Green cities strive to function harmoniously with natural systems. They value their own ecological assets, as well as the regional and global ecosystems on which all people depend. To address climate change, a green city

decouples economic growth from the use of fossil fuel resources by shifting society and the economy toward consumption that relies on renewable energy, energy efficiency, and green transportation.

URBANIZATION

The High Level Committee on Programs of the United Nations System noted that urbanization “may be defined as a process of change from rural to urban ways of living, in physical-spatial, social and economic terms. It is the process by which towns and cities are formed and increase in number and size as more and more people begin living and working in central areas defined as ‘urban.’”

GREEN URBANIZATION

Green urbanization is a process of the population moving from rural to urban areas, where the negative associations to urbanization (urban sprawl, informal settlements, inefficient, public services, and traffic and congestion) are sustainably prevented to account for poverty alleviation and the protection and preservation of the environment.

SECONDARY CITY

A secondary city is a sub-national centre comprised of an urban area within a Secondary City District, which shall provide central place functions, services and facilities having impact or influence beyond District borders. The first occurrence of the concept of secondary city in Rwanda was in EDPRS 2. This document recognized that while many public services are easily available in Kigali (such as inner-city public transport, business registration services, specialized healthcare services, and schooling options), the level and the availability of public and private services are lower in other cities. As the City of Kigali attracts most of growth and investment, the Government of Rwanda decided through provisions of EDPRS 2 to adopt a proactive national urban growth strategy and support the development of a network of secondary cities while Kigali City will be developed as a regional hub. The six secondary cities selected by the Government of Rwanda are Huye, Muhanga, Musanze, Nyagatare, Rubavu and Rusizi. The six cities have been selected based on economic, sociological, and political criteria. The Government of Rwanda believes that

ECOTOURISM

the development of these cities will ensure more balanced regional growth and opportunities for increased access to off farm employment for a larger proportion of the rural population.

Ecotourism happens when a tourist activity takes place in respect of the environment, in favor of the conservation of nature and wildlife, whilst still having social and economic benefits for the communities affected or involved.

WATER SUPPLY SERVICES

Water supply services entail the process of extraction from a water resource, conveyance, treatment, storage and distribution of potable water, including all of the organizational and sensitization arrangements necessary to ensure sustainable services and benefits. This includes domestic water supply (drinking water and other household uses) as well as the provision of water for economic activities through public piped networks.

IMPROVED DRINKING WATER

Improved drinking water sources are defined in terms of the types of technology and levels of services that are more likely to provide safe water than unimproved technologies. In Rwanda’s case, improved water sources include: household connections, public standpipes, boreholes, protected dug wells, protected springs, and rainwater collections.

UNIMPROVED DRINKING WATER

Unimproved water sources are unprotected wells, unprotected springs, vendor-provided water, bottled water (unless water for other uses is available from an improved source) and tanker truck-provided water.

ZERO WASTE ECONOMY

Zero waste economy refers to reducing waste, reusing where possible, and ultimately sending zero waste to landfill.

This means reducing waste generation through improved design; encouraging re-use, recycling and composting; and generating energy from waste cleanly. In short, the elimination of waste flows to landfill.

SAFEGUARDS

Environmental and Social Safeguards – are policies to be incorporated into actions to ensure a more inclusive spread of benefits to both the environment and citizens. As actions are implemented with considerations of the safeguards, the factor of sustainability is also implemented.

IMIDUGUDU

Imidugudu is a program that was launched by the Rwandan Government to rehouse the many hundreds of thousands of returnees after war in 1994. Since 1997 the program has been modified and extended to target rural population more generally. In this later manifestation the plan has been to bring scattered households closer together in villages.



1. Introduction

The purpose of the National Roadmap for Green City Development (NR), is to serve as a practical guide for the Government of Rwanda for planning the six secondary cities that have been identified in the EDPRS 2, the Second Economic Development and Poverty Reduction Strategy. In addition, the NR is an operational tool for the National Strategy for Climate Change and Low Carbon Development, where it paves the way for the development of a climate resilient country by addressing climate change and low carbon emission until the year of 2050.

More specifically, this NR identifies green strategies and guidelines for the foundations, pillars and pull-factors of urbanization, and in turn analyses the gaps for each sub-sector of the infrastructure sector of each of the six secondary cities for greening purposes and existing potentialities of the secondary cities that can spur further green initiatives whilst adding value to the economy. Overall, the NR aims to achieve green urbanization and green growth.

1.1 Background

Rwanda is the most densely populated country in Africa with a population density of 445 habitants per square km. The country's urbanization is a recent phenomenon with an urbanization rate of only 18%, one of the lowest in the world. However, the 4.5% annual growth rate of the urban population far exceeds the worldwide average of 1.8%. Almost half of the urban dwellers live in the Capital, Kigali that is growing at an annual rate of 9%.

To slow down the over-concentrated growth in Kigali and to leverage urbanization as a key factor in for the nation's economic transformation, the Government of Rwanda (GoR) has set a national target of 35% urbanization by 2020. In parallel, GoR has identified six secondary cities to become poles of growth: Huye, Muhanga, Nyagatare, Rubavu, Musanze, and Rusizi¹.

¹ Second Economic Development and Poverty Reduction Strategy 2013-2018.

HUYE



Situated in the Southern province and is the former capital of Rwanda-Urundi. The city was previously called “Astrida” and is considered to be the intellectual centre of the country, where it currently contains the main National University campus.

The city is composed of residential areas in the North and South, and a cluster with commercial, administrative and public institutions in the centre of the city. The agriculture sector is the backbone of Huye’s economic growth and the city has significant opportunities for resource-based manufacturing.

MUHANGA



Out of the six secondary cities, is the closest to Kigali, where most of its economic production is transported to the capital itself. Muhanga has the slowest population growth rate of all of the six secondary cities, with a rate of 1.1% which is half the national average of 2.6%.

The Muhanga’s proximity to Kigali largely explains its slow population growth rate, as movement to the capital in search of opportunities overtakes migration to this secondary city.

Agriculture employs nearly 80% of Muhanga’s district workforce and is correspondingly the largest sector of Muhanga’s city. The other dominating sectors are trade, industry and construction. A number of mining operations are active in Muhanga, but the mineral processing plant operates at only 20% capacity. Muhanga has the potential to become the commercial and financial services hub in Rwanda.

NYAGATARE



Located in the Eastern Province and has the potential to become an agro-trade hub. Of all of the six secondary cities, Nyagatare has the highest population growth rate, which stands at 6.2%. It also has one of the lowest population densities with 242 persons per km² compared to the national average of 445 persons per km², which is indicative of the district's current advantage of having a large amount of available land. The strategic law of limiting 5 hectares of land per person has attracted rural migrants looking for land opportunities.

While Nyagatare is growing rapidly, with an urbanization rate of 9%, it remains the least densely populated city out of the six secondary cities. Overall, there is a lack of infrastructure, such as water and energy, which poses increasing difficulties for accommodating and providing services to new urban dwellers. 80% of Nyagatare's workforce is engaged in agricultural activities and is well known for its cattle breeding and production of milk (Inyange), which dominates the milk market in Rwanda.

RUBAVU



Rubavu is the main tourist destination in Rwanda and is a strategic trading post. It is situated on the northern edge of Lake Kivu and shares the border with Goma in the Democratic Republic of the Congo (DRC). Out of the six secondary cities, Rubavu has the second fastest growing population rate and has the highest population density, which both surpass the national average and makes it the fastest urbanizing city. Rubavu is the only district where agriculture employs less than 50% of the workforce. Rubavu has several large industries that provide employment for its local population: it is home to Bralirwa Breweries, a beverage manufacturer that produces beer and juices; and is where the first Rwandan independent power project, methane gas project, KivuWatt, is situated. While tourism is a significant part of Rubavu's economy, it remains underexploited.

MUSANZE



Situated north of Kigali, is best known as the tourism hub in Rwanda and thus has become the city with the highest income per capita, even compared to Kigali. Musanze hosts tourists for the internationally renowned eco-tourism activities that Virunga National Park offers: Gorilla and volcano trekking. The two secondary cities of Musanze and Rubavu lie in close proximity to one another, thus creating further potential to complement each other with regard to expanding their respective ecotourism sectors.

Musanze has several well-established hotels and restaurants to support its tourism industry. Musanze district has the second highest population density of the six secondary cities but this is not matched with a high population growth. The district has the second lowest population growth figures of the six secondary cities. Agriculture is a vital part of Musanze's economy, employing 67% of the workforce.

RUSIZI



Rusizi has the second highest population of the secondary cities and has a growth rate of 2% per annum, below the national average of 2.6%. It is the furthest secondary city from Kigali, located in the southwest of Rwanda on the border with DRC and Burundi, which has led it to sustain a substantial amount of trade and logistics opportunities. At five persons per household, it also has the highest mean household size in Rwanda. Rusizi's population density is also above the national average. These combined factors are placing stresses on the district's existing infrastructure and the availability of resources. Agriculture employ's the majority of Rusizi's workforce. In addition, economic opportunities already exist in other sectors such as trade and low-tech industry. In particular, Rusizi is home to CIMERWA Cement, which is Rwanda's largest cement producer. High quality local limestone deposits make Rusizi the ideal location for cement production. Other than cement, Rusizi has a number of resource-based manufacturers that process rice, tea and other locally grown produce. Rusizi has underexploited potential in tourism, given its strategic location by Lake Kivu. The low proximity of Rusizi to Nyungwe National Forest is the driving force behind its physical structures, and economic opportunity.

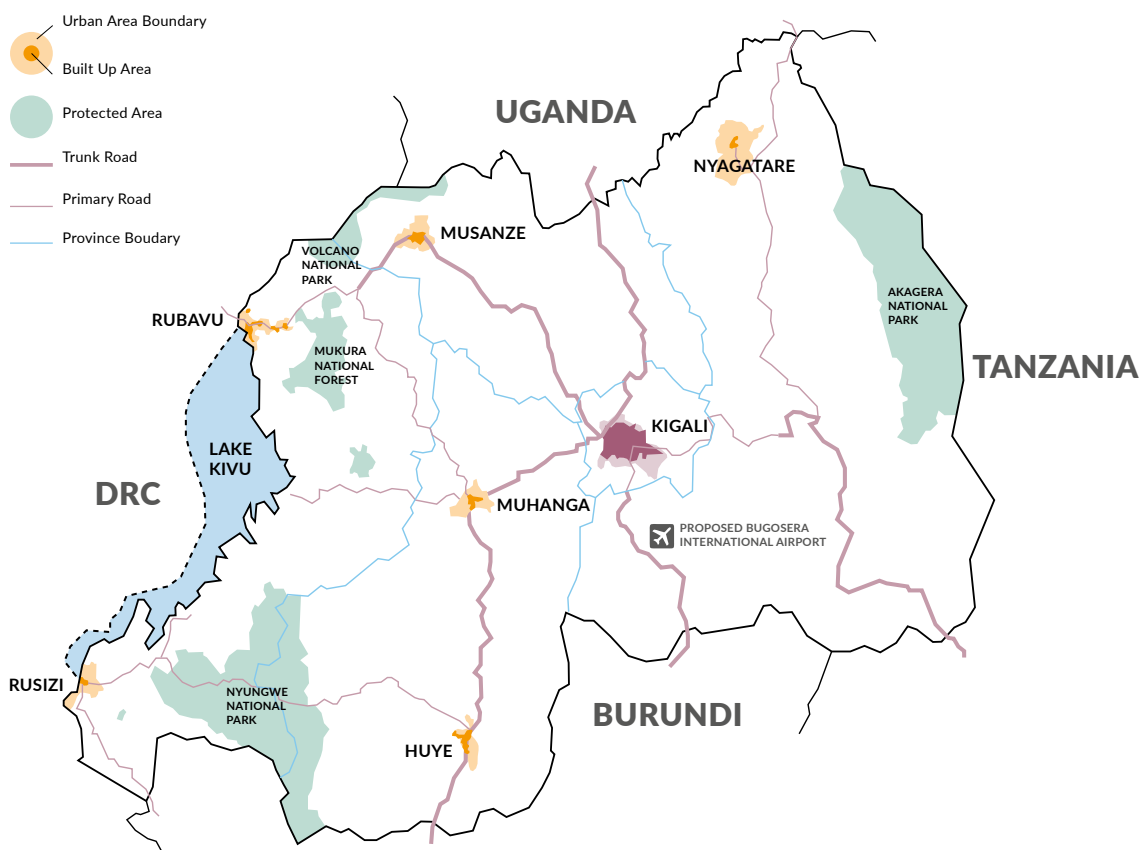
The following map identifies the geographic location of the six city compared to Kigali. The orange shading shows the built up urban areas, and the yellow shading shows the urban boundary that is yet to be developed. Also, it is clear to see the existing connecting roads, protected green national parks, the dominating lake resource in the west, bordering countries, and the prospective development of the International Airport. All of which heavily affect the developments of the secondary cities through various potentialities explored above.

Overall, it is clear that each secondary city has its own unique opportunities to embrace in order to further develop its respective urban advantage. In addition, it is also clear that there are further opportunities to consider in promoting synergistic developments between secondary cities.

Although great diversity of character and opportunity exists both within and between secondary cities, they have in common a commitment and vision of the principles laid out in the EDPRS 2 and in the Vision 2020 plan. This understanding becomes critical to ensure alignment when undertaking planned implementation in order to drive towards economic growth. This momentum for coordinated growth is crucial when considering green initiatives to enable sustainable development.

The overarching goal of **Rwanda's Second Economic Development and Poverty Reduction Strategy (EDPRS 2)**, derived from Vision 2020's long-term goal of 'creating a productive middle class and fostering entrepreneurship' is to 'accelerate progress to middle income status and better quality of life for all Rwandans through sustained growth of 11.5% and accelerating reduction of poverty to less than 30% of the population.'

**FIGURE 1:
THE SECONDARY CITIES OF RWANDA**



From the four thematic areas of the EDPRS 2 (economic transformation for rapid growth, rural development, productivity and youth employment creation, and accountable governance), the NR supports the 'economic transformation for rapid growth' thematic area by contributing to the EDPRS 2 priorities of: (1) increasing the domestic interconnectivity of the economy through investments in hard and soft infrastructure, (2) transforming the private sector by increasing investment in priority sectors, (3) transforming the economic geography of Rwanda by facilitating and managing urbanization and promoting secondary cities as poles of growth, and (4) pursuing a green economic approach to economic transformation.

For the first time, the GoR addressed urbanization as a new standalone sector through Priority Area 4 of the EDPRS 2: (Transform the economic geography of Rwanda by facilitating and managing urbanization and promoting secondary cities as poles of economic growth). Together with Priority Area 5 of a 'green economy' approach to economic transformation, this mandate lends focus to the promotion of green urbanization as well as green innovation in the industrial and private sectors.

Rwanda's ambition for green economy and urban development is also manifested in the National Strategy for Climate Change and Low Carbon Development, which outlines a strategy to help the country become a developed climate-resilient and low-carbon economy by 2050.

Green growth goals are also set out in the **Rwanda National Land Use and Development Master Plan**, approved in 2011. This plan sets the standards for sustainable urban development, where the next ten years will be crucial for Rwanda to succeed in meeting its urbanization goals.

Considering the Rwandan context explored above, the fact that (1) the secondary cities are at early stages of development into their respective urban boundaries and in regard to basic infrastructure and in turn their unique potentialities, and (2) that there exist national priorities, policies and strategies that encourages green urbanization, together they set the ideal environment to implement green growth initiatives.

The NR therefore builds upon this ideal environment for green growth and focuses on the value chain of a city's economic performance: enabling a sustainable decision-making environment; greening the physical infrastructure; greening the extraction, production and consumption of scarce resources; development of incentives for green innovations for more eco-friendly goods and services; and the set-up of a city system that enforces the re-use or recycling of the waste generated. With this, the NR presents the GoR, national and local, with tangible actions along with a clear indication of institutions' responsibilities to make sure there is consistent ownership and accountability during implementation stages.

The overall objective of the National Roadmap for Green Secondary City Development (NR) is to support GoR in implementing the **EDPRS 2**, the **National Strategy for Climate Change and Low Carbon Development**, and the **National Land Use and Development Master Plan**, particularly in the area of green urbanization and green economy growth through secondary city development.

Therefore, the NR is an implementation tool providing direction for tangible action with regard to urbanization of the secondary cities.

Secondary Cities in an urbanizing world



In developing countries, secondary cities are mostly growing in population size and levels of consumption but with fewer capacities to plan and manage urban expansion, and promote green growth and economic development.

In general, there is a tendency that greater proportions of public resources per capita are directed to support the development of the nation's largest city, whilst neglecting the great potentials of secondary city development. This is also true for international development organizations that tend to focus on primary cities and large metropolitan areas characterized by infamous urban challenges².

Notably, for more than a decade there has been little effort made by international financial institutions to target support for the development needs of secondary cities. Most of the large urban-sector programs have tended to focus on large-sector projects to improve roads, water and sanitation in cities with populations of more than 1 million. As a result, support for secondary cities has fallen into a funding gap between large and small urban settlements.

However, due to their sheer growing number in Asia, Latin America and Sub-Saharan Africa, secondary cities have the potential to have a greater influence upon the future economic development of nations along with their corresponding regions.

Also, considering the growing population sizes, it is significant to consider the environmental impacts, resource consumption and pollution. Moreover, bearing in mind that these cities are often at the beginning of their urbanization process, quick wins and tangible gains are possible in terms of green growth, especially as it is a direct contribution to a more dispersed growth. Secondary cities are generally characterized by urban challenges that are 'still manageable' and they offer opportunities to implement strategies and solutions that will make a difference in terms of green growth.



1.2 Methodology

1.2.1 Guiding Principles

Four guiding principles led the focus of the construction of the NR. These principles are a reflection of green growth aspirations and Rwanda's unique current context. Overall, these principles contribute to ensuring the success of sustainable and inclusive growth which accounts for both climate change and poverty alleviation objectives.

Climate change currently poses a threat to the Rwandan economy, where the 2007 National Action Plan for Adaptation (NAPA) underpins this exigency. Rwanda suffers from flooding, landslides, heavy rainfalls, extreme temperatures, heat waves and droughts due to significant variations from the mean state of the climate and high changes in its variability, which have both persisted over a long period of time (a decade or longer). It is crucial to integrate these concurrent threats into the development plans for the secondary cities to satisfy the component of climate resiliency, which contributes to sustainable growth.

Poverty alleviation objectives are incorporated into the EDPRS 2. Making the secondary cities poles of growth for Rwanda, will help adjust the disproportionate spread of wealth within the country and therefore achieve more inclusive growth. In addition, there should be a general outlook of lifting people out of chronic poverty, otherwise the component of sustainability is not incorporated. Therefore a well-rounded increase in opportunities in the cities is fundamental: ideally an integration of increased job-opportunities, and increased access and affordability of quality public services.

Even though it is essential for green urbanization to achieve climate resiliency and poverty alleviation, their impact on society results in new potential threats that also need to be accounted for: urban sprawl, traffic and congestion, informal settlements, inefficient public services and urban poverty. It is crucial for Rwanda to prepare for this, especially as the secondary cities are already facing high urbanization rates. Preparations largely lie on the planning of the land-use to account for both environmental and social effects of population growth.

In this context, the objectives of the NR are the following:



An implementation tool for EDPRS 2 and the National Strategy for Climate Change and Low Carbon Development

In the Rwandan context it is important that a green growth strategy for secondary cities is not an adjunct to, but extends to inform the nature of the plan to increase urbanization to 35% across Rwanda by 2020.

Therefore, the aim of the NR is to identify guidelines and key actions that will enable implementation of EDPRS 2 and **National Strategy for Climate Change and Low Carbon Development**. Primarily, the NR identifies actions that affect Priorities 4 and 5 of the EDPRS 2, but also several programs of action of the National Strategy for Climate Change and Low Carbon Development, notably:

- Program 3: Integrated Water Resource Management and Planning
- Program 4: Integrated Approach to Sustainable Land Use Planning and Management
- Program 7: Green Industry and Private Sector Development
- Program 9: Efficient Resilient Transport Systems
- Program 10: Low Carbon Urban Systems
- Program 11: Ecotourism, Conservation and Payment for ecosystem services promotion in protected areas
- Program 13: Disaster Management and Disease Prevention



A national-level framework identifying roles and responsibilities for the development of the six secondary cities

The main goal of the NR is to identify the path ministries, agencies, international organizations, and stakeholders should follow in order to facilitate and develop the secondary cities of Rwanda. The NR provides a common understanding of the roles and involvement of development partners and it incorporates their ideas and insights. The ownership of the NR is shared, and it aims at contributing to a successful development process for green secondary cities. In this context, the NR is a

multidisciplinary planning tool that proposes potential implementation strategies and ways to implement those strategies.



A guiding document for urbanization and infrastructure development based on green growth

The NR provides green guidelines for the development of the pillars of urbanization. A green guideline provides the requirements and guidance that can be used consistently to ensure that technologies or infrastructure are fit for their purpose, and maximize positive externalities in terms of sustainable urbanization. The prioritization of investment and actions for green secondary cities development has to be based on drivers that are able to accelerate the sustainable urbanization process. Therefore, the NR will provide decision makers the guidance on the hierarchy of actions required to undertake the development of green secondary cities.



An integrated vision between job creation and poverty reduction

A green growth approach to secondary city development will ensure that the secondary cities are viable places where sufficient value is added to sustain employment and avoid increasing urban poverty. In order to attract private investment, each individual investment project must be financially viable. Also, to ensure green benefits, the value of externalities should be explicitly recognized either through regulation or financial incentive. The value-added social and human capital in terms of education, health and poverty reduction afforded by such investment should be factored in, along with environmental impacts.

1.2.2 GGGI Approach

The NR was developed over a four month period, from April to July 2015 by GGGI with collaborative efforts between the GoR, GGGI, development partners, UN-Habitat and the World Bank.

The NR constitutes the focus of component 3 of GGGI's Rwanda Country Program Project: "Develop Rwandan Secondary Cities as Model Green Cities with Green Economic Opportunities". The aim of this project is to support the economic transformation of Rwanda through green urbanization and green growth of the development of its secondary cities.

The NR establishes "how to develop secondary cities as model green cities" and its aim is to provide a clear strategic guidance for GoR and other key stakeholders, in order to plan and implement green urbanization in Rwanda, with special consideration to greening the infrastructure provisions in secondary cities.

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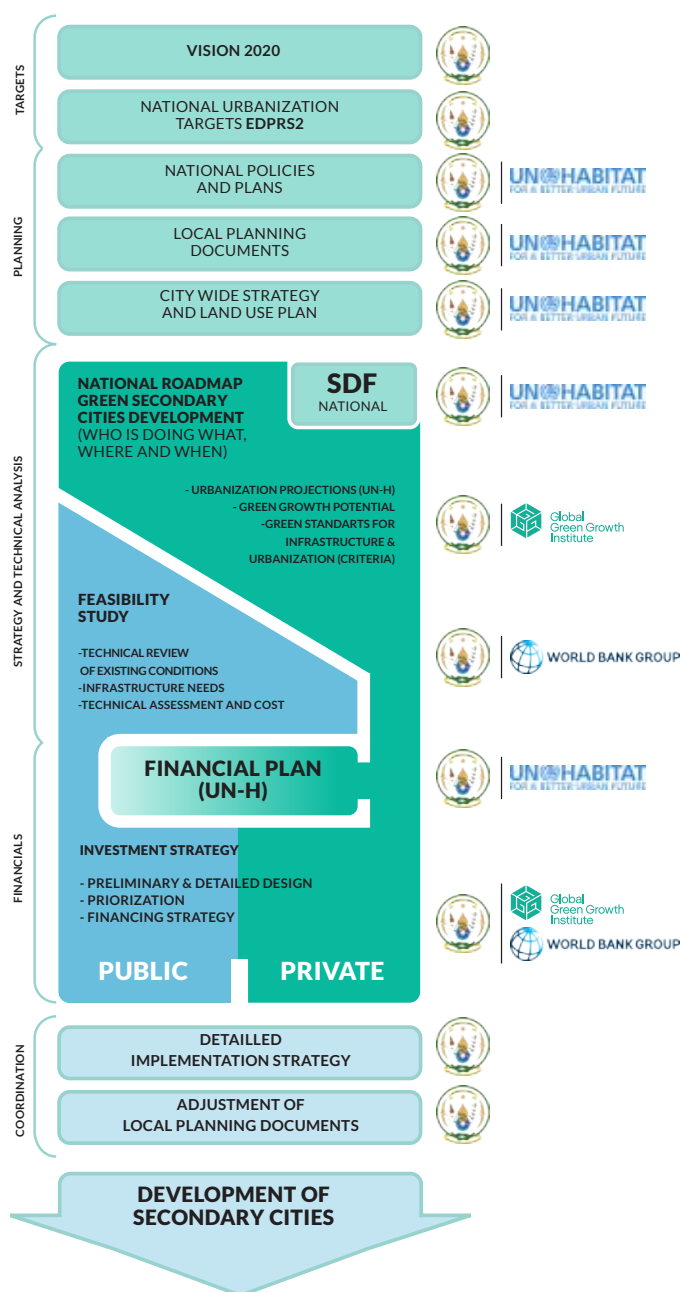
The project is coordinated by the Ministry of Infrastructure (MININFRA), and is directed through a Steering Committee consisting of:

- Ministry of Infrastructure (MININFRA)
- Ministry of Trade and Industry (MINICOM)
- Ministry of Local Government and Social Affairs (MINALOC)
- Ministry of Finance and Economic Planning (MINECOFIN)
- Ministry of Natural Resources (MININRENA).
- Rwanda Housing Authority (RHA)
- Rwanda Environment Management Authority (REMA)
- Rwanda Natural Resources Authority (RNRA)
- Rwanda Initiative for Sustainable Development (RISD)

The NR was developed through a consultative and research intensive process including the following components: desk based research including study of the policies, strategies and action plans as well as research best global practices, and through the GGGI knowledge network platform; continuous collaborations with MININFRA Urbanization Unit; multiple bilateral consultations with all key stakeholders in the public and private sectors, and development partners; and secondary city workshops with city leaders.

The NR project is part of a broader planning process undertaken by the GoR under the leadership of MININFRA. The NR articulates the implementation of planning objectives identified in national and local planning documents, notably the Vision 2020, EDPRS 2, district development plans (DDP), and the urban master plans of secondary cities. Also, the NR was prepared in order to complement a technical feasibility study realized by MININFRA with the support of the World Bank. The aim of this technical feasibility study is to assess infrastructure investment priorities in three sectors that are pivotal for nurturing sustained economic growth: transport, urban services, and energy. The guidelines and key actions identified at the NR will also be integrated in the investment strategy which will complement the MININFRA / World Bank feasibility study. Figure 2 illustrates the general mapping of the secondary cities project.

**FIGURE 2:
GENERAL MAPPING OF THE SECONDARY CITIES
PROJECT**



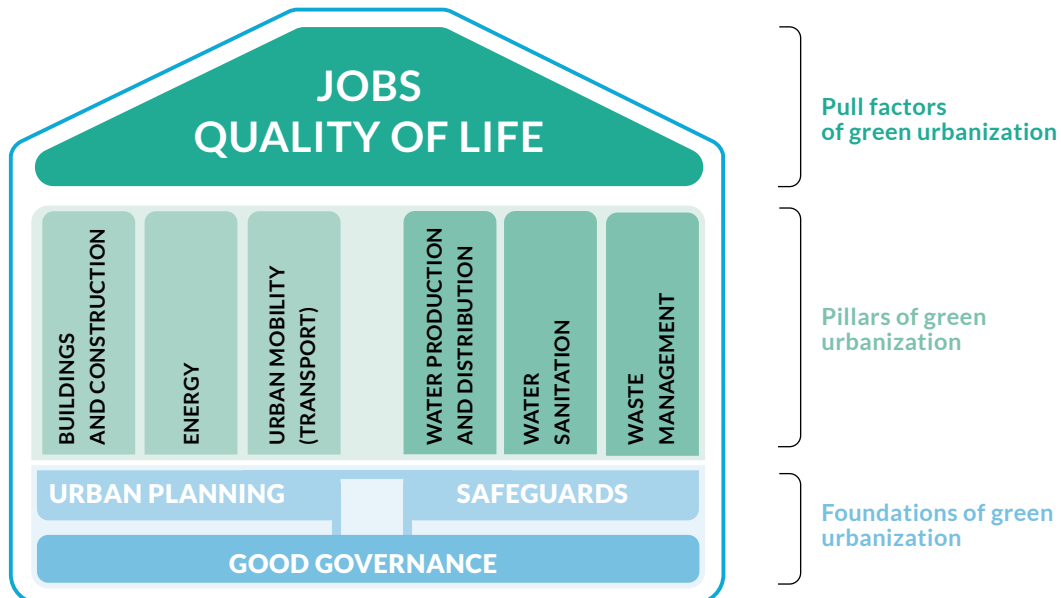
1.3 Foundations, pillars, pull factors, and key actions

The driving force behind the NR is the mechanism of urbanization itself. Understanding the process of urbanization and its components enables clear identification of means of injecting into it green initiatives, which in turn spur green urbanization and therefore enable sustainable associated economic growth.

Rural to urban migration is triggered by a combination of different factors. For the NR to positively intervene in the urbanization process, several categories have been identified to clarify its key components: foundations, pillars and pull factors of green urbanization. These components contribute to visioning the sustainability of the urbanization process, where a city needs a supporting and enabling environment (Foundations) to efficiently build the physical infrastructure needed (Pillars) to, therefore enable the functionality of the city through opportunities and quality of life (Pull Factors.) Figure 3 below, illustrates this relationship to effectively achieve green urbanization.

In addition, this representation helps identify the National and Local actions of this NR in a clearly structured manner to ameliorate understanding. Furthermore, the categories depicted identifies the potential integrated benefits that the actions could have to accelerate progression to green urbanization.

FIGURE 3:
FOUNDATIONS, PILLARS AND PULL FACTORS OF GREEN URBANIZATION



1.3.1 Foundations of Urbanization

The foundations of urbanization are the bases for effective implementation of the pillars of urbanization. Without the consideration of the foundations, urban development would be carried out in an unorganized fashion, where interventions will be inconsistent; initiatives will be unaligned; and benefits will not be socially inclusive.

The first foundation of urbanization is **good governance**. For the development of the secondary cities there is a need for government alignment of proposed urbanization measures from national to local level, and a need for concurrent local ownership and accountability. Therefore the NR provides a clear structure defining the roles and responsibilities along with a sustainable system for constant mainstreaming of priorities and actions. More specifically, NR proposes the establishment of a network for the secondary cities to enable them to exchange knowledge on their successful practices.

The second foundation of urbanization is **urban planning**. Planning serves as an enabling platform for city leaders to drive constructive changes: a planned city is a prepared city that acknowledges and aligns development priorities; it facilitates impact through the developments of the urban growth characteristics (pillars and pull factors of

this NR); it provides a greater level of continuous city affiliation, which can achieve increased provision of credibility; and it anticipates problems instead of dealing with problems as they arise, which is overall cost-effective for the city. To achieve this, the NR identifies the need for improved availability of quality data.

The third foundation of urbanization is **Safeguards**. These Safeguards enable the consideration of both environmental and social policies when planning for implementation.

1.3.2 Pillars of Urbanization

The foundations enable efficient implementation of the urbanization pillars. In turn, the NR identifies green guidelines for each of the six pillars to successfully achieve sustainable green urbanization. This is particularly significant as the secondary cities face population growth and have to adopt mechanisms to efficiently absorb the increased human activity.

There are large gains to be made within the **building** sector in regard to preserving and protecting the environment, and enabling the sustainable maintenance of buildings, as well as facilitating cost savings during their use. Green guidelines on building production and consumption are the most direct approach to reducing GHG emissions while being the highest contributors to it. The NR proposes the promotion of green building designs, the use of high in supply local sustainable materials for construction, and the diffusion of a local green building certification system.

The **energy** sector is the engine of city growth. Energy is needed in all dimensions of growth such as the provision of light in the dark hours of the day; the functioning of electrical devices for production or usage of communicatory devices for increased means of exchanges of knowledge; and even the acquirement of other necessary resources such as treating water for drinking purposes and pumping of water to specific locations. The current national challenges in the energy sector directly affect the development of the secondary cities and its path to green growth. Key parameters to account for to meet the needs of their growth are energy source, supply, capacity and efficiency. Green guidelines of the NR therefore touch upon the production and consumption of

energy for sustainable growth. This includes the following: the national focus on acquiring more sustainable energy sources from renewables for the main grid; the promotion of energy efficient lights; the encouragement of using off-grid renewable energy; and the sustainability of the consumption of wood as a source of energy.

The urban mobility sector is the connectivity platform for urban growth. Cities need an operationalized road network for connectivity and a reliable and efficient public transport system. Such amenities both enable human activity and therefore enable growth. Efficient planning and management is needed due to the negative environmental implications for the use of land from the construction of road and the high levels of congestion from using polluting means of transport. Therefore the NR proposes guidelines for efficient planning with regard to the following: road networks, public transport systems, and the planning of a walkable city. These measures aim to increase connectivity within the city, reduce the amount of polluting vehicles and promote eco-friendly roads that enable cycling.

Water is a necessity for human survival and therefore is a necessity for urban growth. Whether it is for drinking water, for washing measures, for growing crops or for the industrial production of goods and services, it needs to be readily in supply and there is a need to have an implemented system that allows increased access of this resource. As urbanization increases along with household connectivity, water consumption will exponentially increase; thereby consumer behavior will add pressure to the provision of water. This imposes environmental pressures on the water source and the increases the necessity of efficient water treatment. The NR therefore proposes guidelines for the following: preserving and protecting water sources; ensuring access to improved water; improving the sustainability of water treatment; improving the efficiency of the water distribution system; and optimizing water consumption behaviors.

As urbanization increases, human waste increases, therefore a need exists for a good sanitation system. It is an inevitable process that requires proper disposal measures to keep hygiene levels high and avoid unnecessary diseases from forming and spreading. There is potential for the recycling of the sludge for energy generation purposes, as agricultural fertilizer, or simply for decomposition in the soil. The two latter potentials are already common methods of disposal for small population sized areas, however a city will need to develop a large-

scale system. This entails efficient measures for collection, disposal and processing. The NR therefore proposes the following guidelines: plan a sanitation system; adopt efficient collection technology; and plan for the treatment, recycling or disposal of human waste.

The growth in population in the cities due to urbanization increases the amount of general waste produced; therefore there is a need for an efficient **waste management** system. Organic waste can be composted, which is a common disposal method. Non-organic waste however is damaging to the environment, as it does not decompose. Together, organic and non-organic waste, can be collected, separated and treated with the appropriate technologies, using eco friendly approaches similar to the management of human waste. This, again, is deemed more complex when dealing with a larger amount of waste reflecting the larger population size of a city, therefore a need for efficient waste management measures. The NR proposes the following guidelines: the preparation and adoption of a waste management plan; the minimization of waste generation; the improvement of segregation of waste in middle and high-income areas; the improvement of waste collection in low-income areas or already formed informal settlements; the maximization of valorization of waste through composting, recycling and reusing; and the design of eco-friendly landfill sites.

1.3.3 Urbanization Pull-Factors

The urbanization target of 35% requires a large urbanization rate to the secondary cities. This means the cities need to attract the potential dwellers, in other words there is a need to affect the willingness to move to the city – city pull factors. This can be in the form of providing the opportunity of a better quality of life: obtaining employment opportunities and the ability to use public services (from the pillars of the NR).

The ability of the secondary cities to create **job opportunities** increases the chances of a rural dweller to move to the urban area. With the efficient implementation of the green urbanization pillars, the local economy enables the direct creation of green jobs. In addition, with the multiplier effect there will be higher demands in other sectors, such as the services sector, which will create further general job opportunities. Each secondary city has its own economic development potentialities, whereby

further green initiatives can be implemented, such as green tourism, and therefore create further green jobs. The NR therefore proposes strategies that positively influence the pull factors and thus accelerate the development of a green economy and, in turn, to achieve green growth: implement local economic development strategies; invest in the pillars of urbanization; plan the development of eco-industrial parks; support technical training for green industries; promote green technologies; support green entrepreneurship; and assure compliance of Safeguards on green jobs.

The **availability of basic services** in secondary cities, such as accessible quality education, health and infrastructure services, also serves as a pull-factor for urbanization. It is therefore strategic to offer these services but in consideration of the potential dweller – low income dweller – thus they need to be affordable. In addition, the services need to be available to all dwellers therefore a need to avoid exclusion of social groups. For example, supporting the establishment of Early Childhood and Family Development Centres in secondary cities will make the city a family friendly place.

For each group (foundations, pillars and pull factors), green strategies and green guidelines are identified whilst applying these principles to the Rwandan context. This leads to the construction of National and Local actions for ministries, agencies, districts and development partners, which could in turn facilitate and increase private sector involvement. The aim is to achieve a greener growth path through the developments of green urbanization methods in the secondary cities.

1.4 The NR as an evolving tool

An economy constantly faces changes, whether it is from macro-economic components such as inflation and unemployment from changes in interest rates, from micro-economic components such as the profitability levels of an industry due to tax exemptions, or even from urbanization components such as population growth due to increased prosperity levels in the city. Either way, the butterfly effect of every change makes it difficult to foresee its corresponding consequences and control them.

It is therefore crucial that during the implementation of actions proposed in this NR there is a consistent alignment of the overall outcome of achieving a path to green urbanization, especially when economic or social changes directly affects the progress of the NR. Therefore, there is a need to be flexible in regard to national and local actions in order to adapt and overcome these socio-economic changes; adjusting or modifying actions to suit the prevailing circumstances provides this requisite flexibility. In other words, **the NR should be revised and updated if necessary** according to agreed reviewing intervals.



2. Vision for green secondary cities

The development of green secondary cities is crucial for Rwanda and will contribute to reaching the urbanization goals set by EDPRS 2 (32% by 2018) and Vision 2020 (35% by 2020). In order to guide the planning process through green guidelines, there is a need to define the nature of a green city and a vision for green city development in the Rwandan context.

Kimisagara Sector, CITY OF Kigali



2.1 What is a green city?

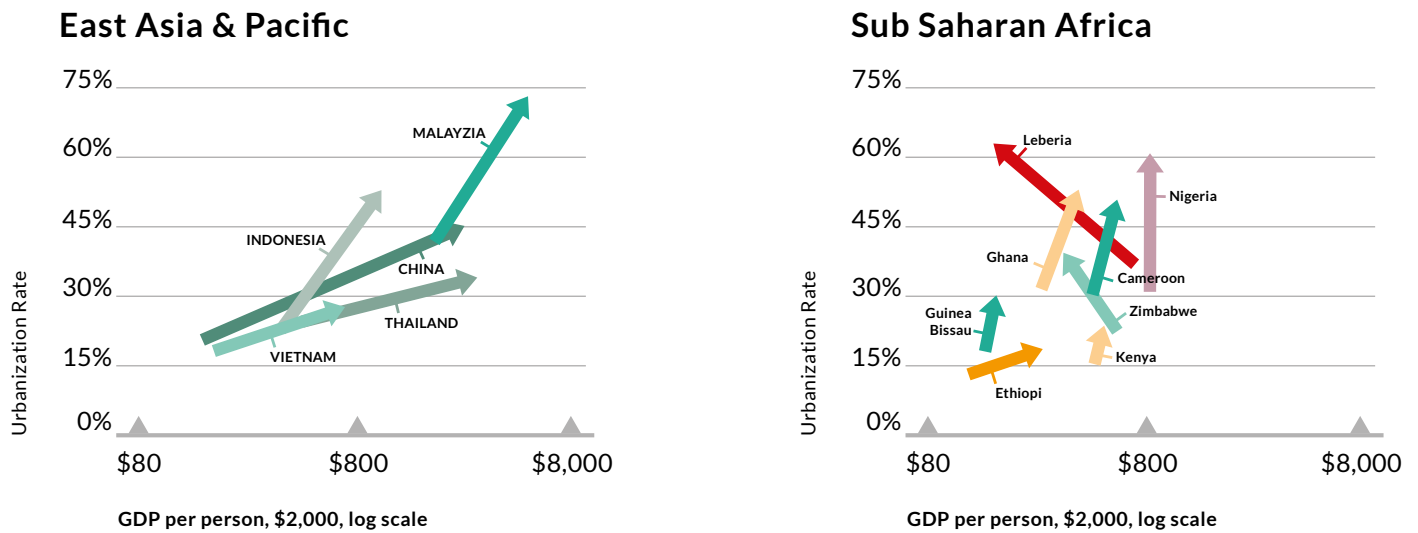
Urbanization is the shift of people from rural to urban areas. The driver of this shift generally come from opportunities in cities that seek to improve the dwellers' quality of life such as greater opportunities for jobs, education, housing, and transportation. In addition cities, usually provide low proximities between services, a reliable mobility network, greater access to resources, and a competitive market environment. Increases in urbanization generate the need to improve supply and efficiency of services and amenities in order to satisfy additional demand. In sum, urbanization serves as a facilitator of economic development, and therefore of economic growth.

Increased urbanization does not always present as a positive relationship with GDP per capita. Figure 4 below illustrates the relationship between urbanization rate and GDP per capita in East Asia, the Pacific and Sub-Saharan Africa. In both East Asia and the Pacific, GDP per capita has had positive correlation with increased urbanization. Some countries absorbed urbanization better than others resulting in bigger GDP per capita growth.

However this relationship is not always positive, as can be seen in Sub-Saharan Africa: in some countries, as urbanization rate increased GDP per capita decreased. Overall, this emphasizes the importance of a city to be prepared to positively absorb potential urban dwellers, especially in aspects that affect GDP per capita.

Preparations should be directed to green urbanization needs to avoid urban sprawl, informal settlements, traffic and congestion, and inefficient public services, and embrace sustainable, improved quality of life.

FIGURE 4:
RELATION BETWEEN URBANIZATION AND INCOME (SOURCE: WORLD BANK)



In order to achieve sustainable growth, development priorities should lie on both poverty alleviation and climate resiliency objectives. For the latter set of objectives, measures include mitigation, the abatement of emissions as well as adaptation and climate proofing.

A **green city** is therefore a city that can uphold green urbanization, and enables and facilitates further green initiatives that further adds value to the economy when the city itself is planning, to all in all, achieve sustainable growth: green growth. In addition, when considering the determinants of a green city, there are two global issues that heavily affect its success: rapid urbanization and climate change.

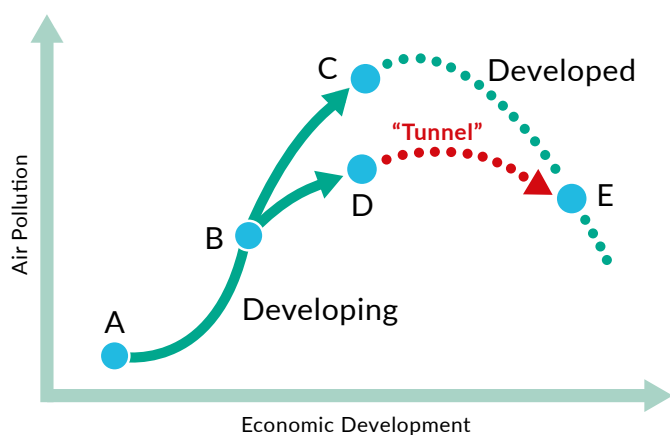
It is important for the city's development to account for environmental aspects, especially through land-use and spatial development planning to achieve low carbon growth overall and build resilience to climate change. City development that does not consider such factors is at risk of irreversible environment damage, and costly modifications for compensatory measures. This means the city faces unsustainable urbanization which poses negative spill-over effects to society.

In fact, due to the urban footprint impact on the global environment the key to sustainability lies in the concept of 'green cities'. A green city brings together multiple forms of sustainable development applied at different urban scales and is locally contextualized.

Historically, developed nations' economic development paths have implied that economic growth is achieved respectively with higher rates of carbon emissions, classically, through cheaper and more polluting methods of industrialization. Munasinghe (1995, 2008), introduced a new green path to achieve successful economic development for developing countries facing rapid growth: a shortcut in relation to the old path.

Figure 5, shows Munasinghe's theory diagrammatically. The old path, A-B-C-E, shows a 'develop first, clean up later' path that developed countries have followed. If developing countries follow this path, in the modern age their growth path will be unsustainable. However, the New Path, A-B-D-E, shows an opportune path that a developing country can take and 'act wise' from the beginning: with international cooperation through technology transfer and fund support for measures against climate change. Therefore this new path is considered to achieve green growth, as economic growth does not require further greenhouse gas (GHG) emissions.

**FIGURE 5:
A GREEN PATH TOWARD ECONOMIC DEVELOPMENT**



A city is an organism that consumes inputs (energy, water, etc.) and produces outputs (waste, air pollution, etc.). The way this ‘organism’ is planned and built has a direct effect on the quantity and quality of resources required – therefore a direct effect on its sustainability.

Considering Rwanda’s low urbanization rate, the development of secondary cities offers a unique opportunity to establish a sustainable framework for urban growth, drawing from its newly established poles of growth - the six secondary cities. Therefore, the planning and development of secondary cities in Rwanda should become a role model for urbanization of other African and low-to-middle income countries around the world. The development of Rwandan green secondary cities will allow a reduction of inputs required by urbanization (energy, material, water, etc.) and minimize pollution and waste, as shown below.

**FIGURE 6:
GREEN URBANIZATION**



2.2 Vision for green secondary cities in Rwanda

The development of green secondary cities in Rwanda must be achieved as part of a coherent vision. This vision must be shared and should constitute a common goal for ministries, agencies and other development partners. Going green must be a key part of the city development agenda in Rwanda, where a green growth agenda for secondary cities will help the whole country to reach its development objectives.

Rwanda is still among the lowest polluters and GHG emitters in the world. As the country industrializes and urbanizes, specific attention must be given to efficiently implementing the policies and corresponding strategies that contribute to achieving efficient, inclusive and highly performing cities. Rwanda has the capacity and willingness avoid following the negative trends of other countries. This includes avoiding the use of energy intensive technologies, and inefficient waste disposal and wasteful water systems.

A specific focus on the secondary cities is another advantage for Rwanda: to increase the poles of growth of Rwanda, from one (Kigali) to a further six (Musanze, Rubavu, Muhanga, Huye, Rusizi and Nyagatare). Each of the poles spread the wealth to the city's corresponding surrounding areas, which increases the ability of the nation to create further resources and in turn increases the ability to mobilize both the new and already scarce resources.

The role of the government is crucial in enabling the success of secondary cities; government leads interventions in the secondary cities and prioritizes investments in these cities that accelerate the diffusion of growth in these urban areas. These actions stimulate other developments within the secondary cities which in turn contribute to their economic growth and further accelerate growth in their surrounding areas. The focus of these actions is to comply with providing the city with the basic infrastructure (energy, transport, buildings, water, sanitation, waste) to enable the city to embrace its direct social and economic benefits and in turn, enable other areas of focus related to employment opportunities in order to add real value to the economy.

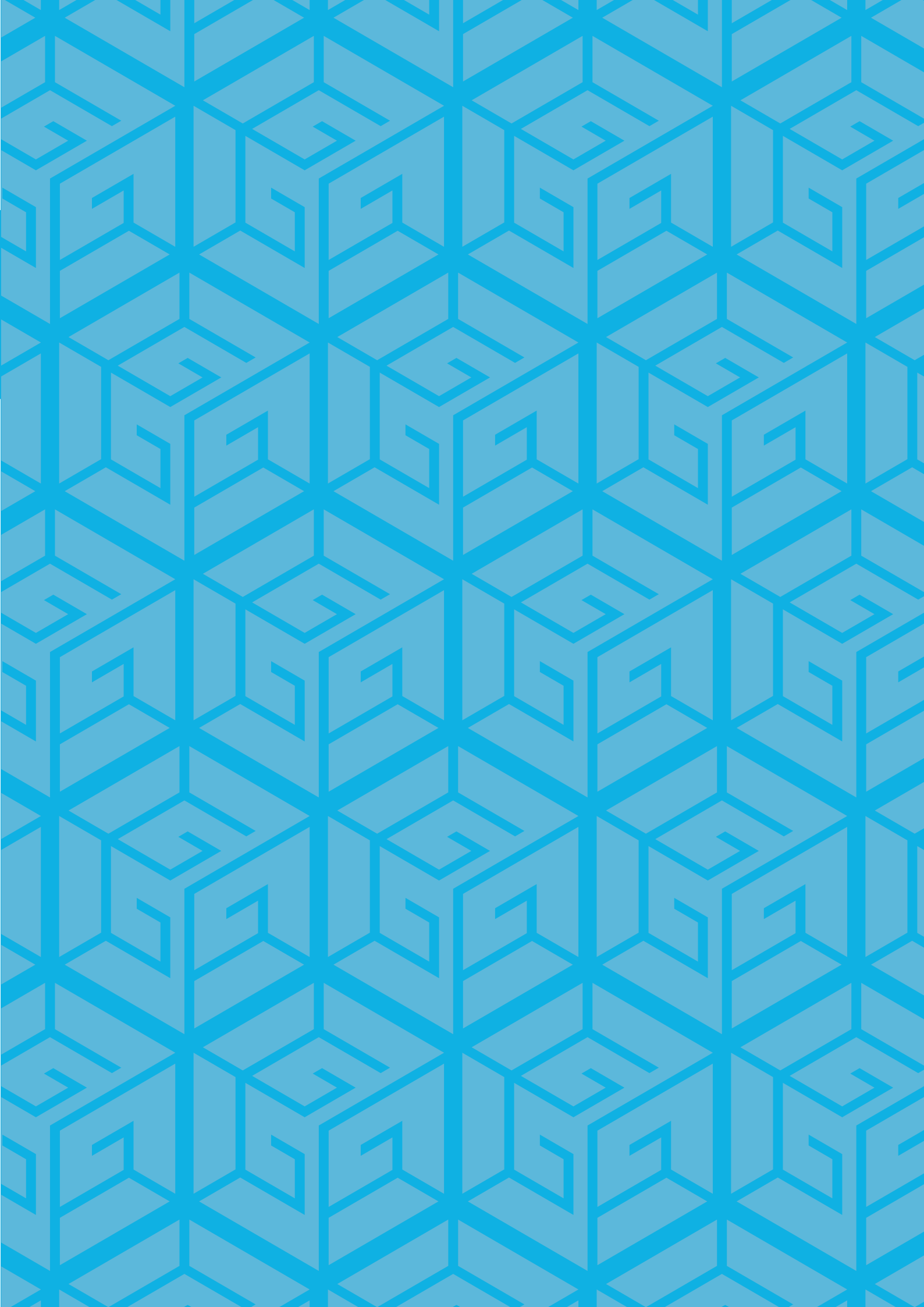
Therefore, the vision for secondary city development is as follows:

By 2050, Rwanda's Secondary Cities will be net zero carbon, resource efficient, and sustain a diverse and inclusive green economy; offering full and high quality employment and employing established and innovative green technologies. Effective urban land and environmental management and planning will draw on a cadre of skilled professional staff with access to state-of-the art data collection and knowledge management technologies.

Investment in integrated, resilient, reliable and sustainable infrastructure will enable the cities to adapt to climate change and function efficiently at the local level, as well as be sustainably linked to their regions and wider economic hinterlands, including to other cities, towns and villages.

Cities will be compact and dense, with continuous, walkable grids thus enabling high levels of access for citizens and supported by integrated transport. Urban layout and design (including public sphere)

will promote healthy cities and the development of social capital through strong social networks. Structures of governance will enable citizens to live prosperous and engaged lives under an inclusive and participatory government. Citizens will have access to good quality, sustainably built and affordable housing in sustainable, well-planned neighbourhoods enabling strong social networks.





3. Demographic targets and pull factors

A review of the current secondary cities' profiles from the first component of the GGGI Rwanda Project show that there are already existing green growth opportunities. The following section is a summary of the main characteristics of the secondary cities, and analyses their corresponding potential for green growth presented using demographic projections taken from the 2012 National Census. These demographic statistics are taken as proxies for the purpose of guidance for achieving a path towards green urbanization.

3.1 Demographic targets

Population targets for each of the secondary cities are set in the contexts of their corresponding master plans in order to achieve the 35% urbanization target. Growing from 18% in 2012 to 35% by 2020 is ambitious, and thus there is an urgent need for government intervention, not only to reach these targets but to achieve a green path. Rwanda's secondary cities being at early stages of urbanization, in turn, serves as an advantage in order to act now and be prepared. The urbanization rate in Rwanda is high: dominantly in Kigali with an annual urbanization rate of 9% whilst the secondary cities face varied rates ranging from 2% to 9%. The pressures from scarce land, scarce resources, growing population and limited urbanization capacities in Kigali emphasizes the need to grow secondary cities as new urban areas. Currently, Rwanda has achieved 18% of urbanization and is directing efforts to achieve the Vision 2020 target of 35% urbanization (32% by 2018 under EDPRS 2).

The baseline population data of each secondary city is taken from the 2012 National Census. In addition, the following indicators are taken of the secondary cities: urban population, proportion of the urban population to rural, urban growth rate, and average size of households in urban areas. The urban population of secondary cities was defined based on the current population of the sector within each city's urban boundaries.

The NR takes the secondary city master plan's population targets for 2020 as given, as these are the figures the government and the districts are currently utilizing.

Additionally, the average number of people per household in each of the districts is taken to account for the expected growth of households in 2020 and is assumed to be constant.

To avoid confusion, figures of city size and current Floor Area Ratio (FAR) for each of the secondary cities have been utilized as per UN-Habitat's Rwanda Program to enhance cohesion of work being mainstreamed at government and local level.

Table 1 on the following page is a summary of the demographic targets for each secondary city, where overall it projects the urgency of government intervention to achieve a path toward 35% urbanization by 2020.

**TABLE 1:
DEMOGRAPHIC TARGETS FOR SECONDARY CITIES**

DEMOGRAPHICS	HUYE	MUHANGA	NYAGATARE	RUBAVU	MUSANZE	RUSIZI
Population of the district (2012)	328,398	319,141	465,855	403,662	368,267	400,858
Population of the urban area (2012)	52,768 (16%)	50,608 (16%)	47,480 (10%)	149,209 (37%)	102,082 (28%)	63,258 (16%)
Current urban population growth rate	1.9%	2.6%	9%	5%	1.8%	2.4%
Mean size of urban private households (2012)	3.9 persons	4.1 persons	3.9 persons	4.3 persons	4.4 persons	4.6 persons
Urban population by 2020 (target)	103,654	111,901	181,600	421,124	236,638	137,315
Expected growth between 2012 and 2020	+ 50,887 or + 13,048 HH	+ 61,293 or + 14,950 HH	+ 134,120 or + 34,390 HH	+ 271,915 or + 63,236 HH	+ 134,556 or + 30,581 HH	+ 74,057 or + 16,099 HH

3.2 Push and pull factors for urbanization of secondary cities

The circumstances behind the decision to migrate from rural to urban areas are known as ‘push’ and ‘pull’ factors. Push factors are the reasons for leaving the rural area, and pull factors are the reasons for moving to the urban area.

For every push factor, its opposite is a pull factor, and vice versa. Overall, these factors are the causes of population changes in both rural and urban areas. Table 2 below shows examples of such factors.

**TABLE 2:
SUMMARY OF POTENTIAL PUSH AND PULL FACTORS**

PUSH FACTORS FROM RURAL AREAS	PULL FACTORS TO CITIES
Unemployment	Job Opportunities (Off-Farm)
Poor Housing Conditions	Affordable And Good Quality Housing
Weak Infrastructures	Basic Infrastructure (Water, Sanitation, Electricity)
Lack Of Services And Amenities	Service Provision (Health And Education)
Poor Transport Options	Good Physical Connections
Rural Poverty	Greater Wealth Or Affluence

Globally, the dominant pull factors of urbanization in developing countries are hard cash (from higher average salaries and higher range of job opportunities), bright light syndrome (from the acquisition of access to technologies that extend opportunities and enable a transition to a different lifestyle), safety (from conflicted rural areas) and survival (from improved access to better services for human necessities). In other words, rural to urban migration is driven by the acquisition of better public services and job opportunities.

needed from the beginning. Land is scarce in Rwanda, therefore any plans of constructing new infrastructure for urbanization needs to be strategic, otherwise there is high risk of conducting irreversible damaged to the environment and gives leeway to inefficient use of land that can incur further costs to society. If successfully done, the economy stands to benefit from further opportunities of economies of scale.

In Rwanda, the urbanization target of the government is ambitious, and will require specific attention to be given to pull factors in order to attract citizens into secondary cities.

Considering the current low level of urbanized population (both nationally and at secondary city level) and the targets of reaching 35% by 2020, Rwanda needs to be prepared for a fast rate of urbanization. However this is deemed difficult to happen without government efforts on secondary city pull factors to alleviate pressure on the fast growth of Kigali City.

The focus on the pull factors, in turn, needs to consider aspects of green urbanization to encourage a growth path towards sustainable city development, which in turn enables the consistency of its relative growth. This is especially crucial when facing fast rates of urbanization as the city is vulnerable to urban sprawl, traffic and congestion, informal settlements and inefficient public services if not properly prepared. Therefore, taking into account the rate of population growth is important to continuous and efficient planning of limited resources to spur pull factors.

Initial efforts to account for the negative externalities pointed out in the last paragraph and effectively implement the pull factors will be challenging. Firstly, due to the current low population densities in the secondary cities, initial investments will be high in order to reach a certain readiness level to attract potential dwellers and to maintain public services. The costs will decrease over time when the urban migrants dwellers contribute to the economic growth of the corresponding city, and when constructed infrastructure also generates outputs back to the economy facing maintenance and updating costs only. Secondly, strategic technical urban planning will be



4. Foundations of green urbanization

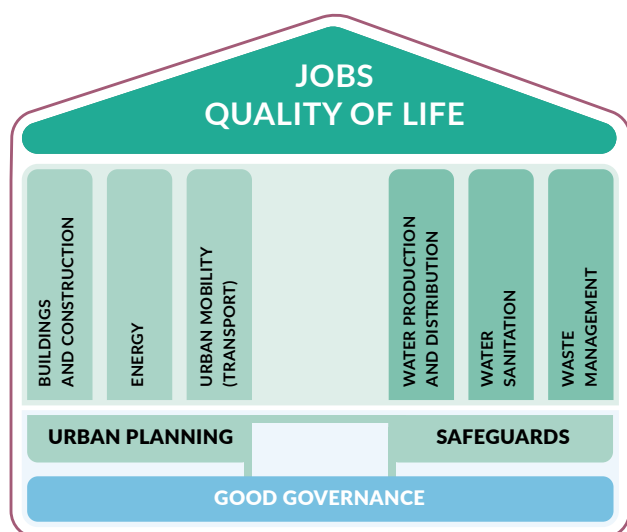
The foundations of urbanization are the basis of a sustainable city: Good governance, urban planning and the compliance with social and environmental safeguards are the basis of green urban growth. These foundations are intangible but they provide a solid basis for sustainability and infrastructure investment.

In this regard, a green urbanization approach requires that the decision-making process at the urban level be efficient transparent and inclusive. Moreover, decisions have to be made following a plan that provides a long-term vision for the development of a city. Furthermore, planning and decision-making on investment must comply with safeguards.

The three 'foundations' are interlinked and imply the adoption of a green growth perspective for urban development. Consequently, the first step toward the creation of a green city is the adoption by all stakeholders (ministries, agencies, districts, institutions and private sector) of a work philosophy that promotes good governance, that recognizes the importance of urban planning, and that supports the enforcement of social and environmental safeguards prior to project implementation.

Centre of the City of Rubavu





4.1 Good governance

The National Roadmap for Green Secondary City cannot be successfully implemented without good governance. The Roadmap depends on efficient decision-making and the successful process of its implementation.

As urban development becomes the driving force of national economic growth, city planning induces a greater concentration of decision-making. This therefore puts cities in the centre of the discussions about sustainable development.

Decision-making directly focused on green growth would alleviate the need for the government to make future decisions compensating for market failures arising from inefficient allocation of scarce resources. Failure to consider the environment or the negative effects of climate change poses a large problem with regard to inefficiencies and market failures, and this is emphasized during the transformation of a city as urbanization increases. The decision makers need to be ready to create a sustainable system that will absorb green initiatives and in turn influence green innovations.

Good governance could be considered as the first foundation of green urbanization. Therefore, the implementation of the National Roadmap will be anchored on good governance both at the national and secondary city levels. For the purpose of consistency

and strengthening existing governance structures and institutions, governance will be defined in line with the government's definition as: *"the exercise of political, economic and administrative authority to manage the nation's affairs and the complex mechanisms, processes, relationships and institutions as well as leadership behavior through which citizens' groups articulate their interests, exercise their rights and obligations and mediate their differences ».*³

4.1.1 What is good governance?

According to the UN definition, the ideal framework of governance possesses eight characteristics as shown in Table 3 below. Overall, this framework is an assurance to the nation that corruption is minimized; all views are incorporated into the decision making process (particularly those of minority and vulnerable groups); and that the governance process is responsive to the nation's development priorities.

The first pillar of Vision 2020 is 'Good Governance and a Capable State'. Vision 2020 stresses that "the State will ensure good governance, which can be understood as accountability, transparency and efficiency in deploying scarce resources".

The document also points out that "people's participation at the grassroots level will be promoted through the decentralization process, whereby local communities will be empowered in the decision making process, enabling them to address the issues which affect them the most".

The table on next page describes the characteristics of ideal governance, as prescribed by the United Nations, Economic and Social Commission for Asia and the Pacific.

3 Ministry of Local Governments 2015, <http://www.minaloc.gov.rw/index.php?id=28>

**TABLE 3:
CHARACTERISTICS OF IDEAL GOVERNANCE**

CHARACTERISTICS	DESCRIPTION
Participatory	<ul style="list-style-type: none"> • Equity of access to, and active participation by women and men • To be informed and organized
Consensus oriented	<ul style="list-style-type: none"> • Existence of several actors and points of view • Ability to reach a broad consensus under long-term perspective on needs for sustainable development
Accountability	<ul style="list-style-type: none"> • From government, private sector and civil society organizations to the publics and institutional stakeholders • Cannot be enforced without transparency and the rule of law
Transparency	<ul style="list-style-type: none"> • Decision-making that follows rules and regulations • Decision-making information freely available to those affected by decision • Clear understandable information availability and media
Responsiveness	<ul style="list-style-type: none"> • Credibility of implementing timeframe to all stakeholders
Effective and efficient	<ul style="list-style-type: none"> • Results produced meet the needs of society whilst optimum use of limited resources • Sustainability use of natural resources and the protection of the environment
Equitable and inclusive	<ul style="list-style-type: none"> • Avoiding exclusion of groups in society in decision-making • The most vulnerable to have the opportunities to improve and maintain their well-being
Follow the rule of law	<ul style="list-style-type: none"> • Fair legal framework that are enforced impartially with independent judiciary and impartial and incorruptible police force • Full protection of human rights, particularly those of minorities


Source: Adapted from United Nations, Economic and Social Commission for Asia and the Pacific, *What is Good Governance?*

4.1.2 Green strategies for good governance in secondary cities

Good governance is a foundation for green growth. As such, good governance practices are essential for sound management, accountability, and compliance with democratic principles. Moreover, for secondary cities, good governance means promoting expertise and innovation at the city level in order to improve the efficiency of the government itself.

Also, in reference to the National Gender Policy of Rwanda, good governance must ‘ensure gender sensitive representation and effective participation of women and men, girls and boys in decision making positions, at all levels; equal participation of women and men in policy design, planning, implementation and evaluation of public development programs; facilitates gender budgeting processes at central and decentralized levels; and ensures efficient public administration and transparency mechanisms are in place and gender sensitive.’

The roll out of the NR will be based on existing institutions and their roles in the implementation of Rwanda’s urbanization policy both at the national and district level. This approach supports the process of the past government’s efforts to advance “...a pragmatic view of how to strengthen the existing institutional framework on a step-by-step basis by supporting processes that promote particular attributes of good governance...”

 **Strategy 1:**
Define the specific roles and responsibilities of a secondary city

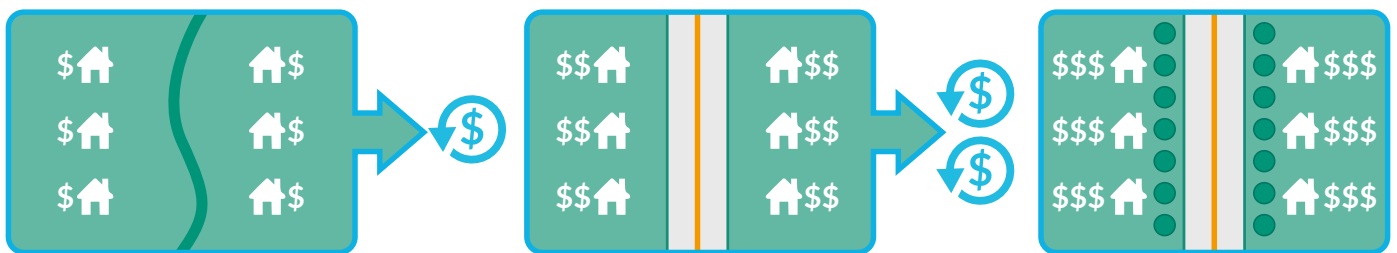
The cities of Huye, Muhanga, Nyagatare, Rubavu, Musanze and Rusizi were identified in the EDPRS 2 as secondary cities to serve as poles of growth. This entails parallel developments in increased urbanization therefore increased population growth, which in turn increases pressure on infrastructure. Such challenges will require additional resources in terms of skills and expertise, but also in terms of financial capacities. Therefore, the

definition of the secondary city status, and the roles and the responsibilities of a secondary city is significant and could contribute with the alignment of national targets with local priorities. Moreover, defining the roles and responsibilities of local government in charge of secondary city development will improve levels of accountability and ownership, which will positively influence a successful path to green growth.

Strategy 2:
Increase financial resources and local revenues

Implementing a vision requires resources. In order to finance the development of secondary cities, city districts need stable funding from national budget and revenues from taxes, investors, and donors. In order to guarantee public investments in the long term, urban development cannot rely on 'new' money. Step-by-step the funding for investments should be generated through the urban area itself (for example from a reliable property tax system or from other mechanisms). For example, one mechanism allowing a city government (and the urban citizens) to benefits from real estate development is called 'land value sharing', where public revenues from land and property taxes generated by an area are deployed into improving public space locally. In return, these improved spaces acquires an increase in the land value itself and therefore an increase in local public revenue.

FIGURE 7:
LAND VALUE SHARING PROCESS



Source: Adapted from UN-Habitat – Planning for urban areas in Rwanda.

The following figure illustrates the land value sharing process. Public revenues from land and property taxes are absorbed to improve public space. The improved public space will in turn generate more revenue and more public incomes.

There will also be an additional sum of revenue to the total accumulated directly from the development of an environmental tax at national and local level. For example, there would be both a “polluter tax” and a “consumer tax”. The polluter tax involves revenue gains from direct taxes on the pollution created. The consumer tax involves revenue gains from taxes on the extraction or use of the natural resources.

Strategy 3:
Facilitating exchange of experience and good practices

All secondary cities face similar challenges in terms of management and infrastructure development. Also, they are united by the common objective of accelerating the process of urbanization and accommodating the dwellers from rural areas. To this effect, successful practices and experiences must be shared among leaders of secondary cities. As such, the creation of a knowledge-exchange platform for secondary cities offers an opportunity to disseminate good practices among cities facing similar

challenges. A knowledge-exchange platform can take many forms such as a yearly or a half-yearly symposium bringing together the Minister of infrastructure, mayors, vice-mayors and high-level officials from other ministries and agencies.

The **Rwanda Association of Local Government Authorities (RALGA)** is an existing structure that was established by the districts to enable them to fulfil the new responsibilities entrusted to them under the decentralization policy adopted in 2000. As a membership organization, RALGA is mandated to represent and advocate for the interests of the local governments of Rwanda. The creation of a specific **Secondary Cities Committee** within the structure of RALGA offers the opportunity to develop a knowledge exchange platform between the six cities.

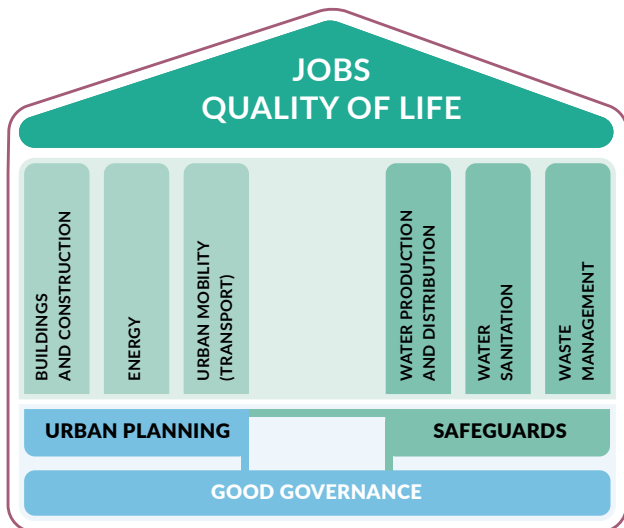


Strategy 4:

Develop the capacities of districts decision-makers and technicians

The local officials and technicians of districts are the entry-point for infrastructure and building projects sustaining urbanization. In order to implement and accelerate green growth practices it is imperative to support the training of staff in technical and managerial areas. Policies are often developed in Kigali, but implementation is done locally at the district level. Thus, the development of a continuous education program or the implementation of a direct coaching program targeting local technicians in charge of urbanization is relevant and would contribute to providing the skills needed to face the challenge of rapid growth.





4.2 Urban planning

Urban planning concerns the coordination of spatial planning of various sectorial policies for the composition of a city-based strategy.

More complex and diverse than land-use regulation, urban planning addresses the opportunities and constraints among sectorial policies. For example, dealing with the mixture of priorities during decision-making, whether it is for economic development and or environmental preservation and protection. The strategic function of urban planning is to promote a rational arrangement of activities and to reconcile competing policy goals at the city-level.

Urban planning allows for the identification of long-term and medium-term objectives for a territory that deal with land use and physical development, and coordination of sectoral policies with regard to housing, transport, infrastructure and environment. For example, integrated housing and economic planning can support the development of dynamic communities.

Forward-looking urban planning can also facilitate a city's capacity in entrepreneurship, connectivity, sustainability and inclusivity. It has a direct impact upon a city's

competitiveness level, economic growth, its capacity to conduct investment, and its ability to provide a good quality of life for its inhabitants. Urban planning also plays a key role in determining the level of mobility within cities, the costs of residential and business properties, and the provision of efficient public services.

In contrast, a failure to provide coherent urban planning would result in a variety of issues, such as urban sprawl, informal settlements, inefficient public services, and traffic and congestion.

Consequently, good and coherent urban planning is a basis to green growth and should be an essential component in the development of secondary cities. The urban planning process will help make sectorial policies and actions of relevant stakeholders' coherent, efficient, and allow for well-coordinated implementation, so that shared common development goals can be achieved. This would result in socio-economic development opportunities which would in turn serve as pull factors for rapid urbanization.

In summary, urban planning is a pillar of urbanization: as it provides a comprehensive vision for the future; it organizes the action of public and private entities with respect to the physical components of a city; and it gives direction to investors.

4.1.2 National context of Rwanda with regard to urban planning

Rwanda has a coherent urban planning system. In accordance with the law governing urban planning and building in Rwanda⁴ the structures in charge of urban planning and building are MININFRA, RHA, and decentralized entities (districts). A Ministerial Order provides the compliance mechanism and sets the hierarchy between planning instruments. As stated in the order from Figure 8 on next page, master plans should be aligned with each other at each level. In parallel, DDPs and investment plans should also link to these master plans. The planning hierarchy of Rwanda provides the framework for a coherent urban planning process where local actions have to comply with the orientations and objectives of the metropolitan and national planning instruments. The compliance process of the content of a planning tool is under the leadership of a structure called the '**Urban Planning Coordination Meeting**'.

Moreover, all planning instruments must comply with the provisions of the **Urban Planning Code (UPC)**. The UPC is an important tool for the preparation and implementation of physical plans, as it provides the principles for the sustainable development and management of land use for human settlement. It is binding for all categories of land planning within urban areas for any development and investment project, be it for a public institution, tourism-based, public spaces, urban renewal or infrastructure servicing. Considering the legal framework of urban planning in Rwanda, the implementation of the NR will take place through single projects, but also through the

actualization of the Master Plan for Land Management and Urban Planning (MPLMUP) for urban areas. As the MPLMUP of an urban area provides guidance in areas such as transport, water reticulation, electricity network and energy, sanitation, housing, environment, education, tourism, and forestry, an actualization process based on the provisions given in the NR will be an opportunity to include green urban growth strategies in the planning documents. The following table shows the specific content of each planning document guiding the spatial and economic development of Rwanda.

**FIGURE 8:
LINKAGE BETWEEN PLANNING DOCUMENTS**



**TABLE 4:
CONTENT OF RWANDA PLANNING DOCUMENTS**

PLANNING DOCUMENTS AND THEIR SPECIFIC CONTENT				
Physical Planning (National and District)		Economic Planning (District)	Urban Planning (Secondary City)	
National Land Use and Development Master Plan	District Land Use Master Plan	District Development Plan	Master Plan to Land Management and Urban Planning	Local Development Plan
National	District	District	Urban area associated to a secondary city (1:50 000 or 1:100 000)	Neighbourhood of a secondary city
MINERENA	MINERENA	MINALOC	District (MININFRA)	District (MININFRA)
<ul style="list-style-type: none"> Land use plan Coordination of visions, policies, strategies and practices affecting land use and development Guidelines on land use and management 	<ul style="list-style-type: none"> Background study Land use plan Proposed projects to be implemented for the 5-years period Monitoring and evaluation 	<ul style="list-style-type: none"> Background study Strategic framework based on EDPRS 2 (district priorities for the 5-years period) Implementation (action, roles, coordination mechanism, resource mobilization) Monitoring and evaluation 	<ul style="list-style-type: none"> Background study Planning component Development proposals (housing, economic development and employment, public institutions and social services and facilities, transportation and road network, sanitation and utilities, urban renewal, environmental protective measures) 	<ul style="list-style-type: none"> Background study Planning component Development proposals Zoning regulations (building layout requirements and development parameters, road design and parking, landscaping, utilities and infrastructures)

A MPLMUP is available for each secondary city's urban area. Table 5 below synthesizes the current status of planning documents currently in effect.

**TABLE 5:
PLANNING DOCUMENT IN EFFECT IN SECONDARY CITIES AS OF JULY, 2015**

DISTRICTS	HUYE	MUHANGA	MUSANZE	NYAGATARE	RUBAVU	RUSIZI
DDP	2013-2018	2013-2018	2013-2018	2013-2018	2013-2018	2013-2018
Local Land Use Plan	Final draft, waiting for District approval	In effect	In effect	In effect	In effect	Final draft, waiting for District approval

URBAN AREAS	HUYE	MUHANGA	MUSANZE	NYAGATARE	RUBAVU	RUSIZI
Master Plan and Local Urban Development Plan	Huye City Local Urban Development Plan 2011-2020 (MININFRA 2011)	Étude du plan local d'aménagement et d'urbanisme de la ville de Muhanga (MININFRA 2011)	Élaboration du plan d'aménagement local de la ville de Musanze horizon 2025 (MININFRA 2008)	Élaboration du schéma directeur de la ville de Nyagatare (MININFRA 2009)	Local Urban Development Plan for the Town of Rubavu (MININFRA 20011)	Cyangugu Town Master Plan 2005-2020 (MININFRA 2005)
Detailed Physical Plan	Detailed Master Plan for priority sites (500 Ha) - 2012	Detailed Master Plan for priority sites (500 Ha) - 2013	Detailed Master Plan for priority sites (1000 Ha) - 2014	Detailed Master Plan for three sites (278, 186 and 82 Ha) - 2012	Detailed Master Plan for priority sites (500 Ha) - 2012	Detailed Master Plan for priority sites (100 Ha) - 2014

Sustainable urban planning principles have been incorporated in the MPLMUP of secondary cities' urban areas. For example, the plans encourage higher densities notably by the construction of high-rise buildings, the development of Imidugudu settlements rather than scattered rural houses, and decreasing size plots to 15 meters by 20 meters. Urban sprawl has also been addressed in the master plans.

However, In terms of sustainable planning, the provisions of master plans of secondary cities could benefit from integrating more detailed green strategies. In this respect, the strategies and guidelines of the NR with regard to urban planning and infrastructure development could be integrated in the master plans in the context of an actualization procedure.

Additionally, MINALOC is currently revising the DDPs for the 30 districts of Rwanda. This has been established in collaboration with LODA and RHA, and is being undertaken in order to integrate sustainable and environmental guidance at the district level.

4.1.3 Prospective needs of secondary cities in terms of land consumption

GoR identified an urbanization target rate of 35% by 2020. As discussed previously, 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.

In 2014, the Rwanda Program of **UN-Habitat** identified broad land requirements for the expansion of secondary cities until the year of 2045. Based on general assumptions on current urban population, growth factors and current Factor Area Ratio (FAR), UN-Habitat estimated how much land would be needed to develop secondary cities and accommodate the projected growth.

Based on the urbanization targets, their demographic projections give a noteworthy insight into the number of hectares of land needed to provide housing, economic activities, public facilities and sufficient public space to new inhabitants. Moreover the model provides a comparison between the needs associated for a continuation of a low-density growth pattern, and the need associated with a medium-density growth pattern (FAR of 1.0). However, a medium-density growth pattern requires a significant changes and adaptation from current of Rwandan urban development practices.

Table 6 below shows the land required to accommodate demographic growth projections, which is based on the EDPRS 2 target. The identification of land required to sustain urbanization is established on a working hypothesis based on current approximate FAR. Also, the land required includes the space needed for economic activities (retail, industries, institutions), as well as space for infrastructure, the road network and open green spaces.

**TABLE 6:
PROSPECTIVE LAND NEEDS OF SECONDARY CITIES**

	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
Expected growth (population)	50,886	61,293	134,120	271,915	134,556	74,057
Average urban household size	3.9	4.1	3.9	4.3	4.4	4.6
Expected growth (households)	13,048	14,950	34,390	63,236	30,581	16,099
Approximative current FAR	0.25	0.25	0.25	0.40	0.35	0.25
Land required for growth with current FAR	939 Ha	1,076 Ha	2,476 Ha	2,846 Ha	1,573 Ha	1,159 Ha
Land required for growth with an FAR 1.0	235 Ha	269 Ha	619 Ha	1,138 Ha	550 Ha	290 Ha

Source: GGGI Rwanda Country Program & UN-Habitat Rwanda Country Program

These land requirements emphasizes the need for planning and constructing new neighbourhoods in order to accommodate population growth in a coherent and sustainable way. Not adopting a rigorous urban planning process would give leeway to the negative outcomes of urbanization to develop.

A 'business-as-usual' approach for the 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.

In order to plan the expansion of secondary cities in a sustainable way, the following section provides green guidelines for new neighbourhood design. These guidelines are general but should be taken in consideration for the preparation or revision of the following planning tools:

- District Development Plans (DDP)
- Master Plans for Land Management and Urban Planning (MPLMUP)
- Local Land Development Plans (LLDP)

- Specific Land Development Plans and Land Subdivision Plans (LSP)
- Land re-plotting plan
- Land restructuring plan
- Specific Development Plans (SDP)

4.1.4 Green strategies for urban planning of secondary cities

Urban planning is a foundation for the green growth of secondary cities of Rwanda. Therefore, the urban planning process for the areas to be developed or retrofitted (existing city centres), has to be based on green strategies so that development falls within the principles of sustainable development.

The following green strategies for urban planning should guide the planning process for secondary cities.



Strategy 1: ***Urban planning has to be based on accurate data***

The planning and monitoring of urban development requires data on the population, households, access to services and infrastructure, education, motorization, etc. This data is useful to ministries and agencies, districts, city councils, private sector, NGOs, international organizations, and the labor market in order to support good decision-making.

The **National Statistical System of Rwanda (NSS)** is made of four key components:

- The Integrated Household Living Conditions Survey (EICV): conducted at five-year intervals since 2000/2001. With the high demand for statistics from EICV, and in accordance with international recommendations, EICV is now conducted every three years since 2013/2014.
- The Demographic and Health Survey (DHS): conducted every five years, but is to be conducted every three years from 2014/15 because of the high demand for health statistics.

- The National Agriculture Survey (NISR): conducted annually, the data collected is related to agriculture.
- The Population and Housing Census (PHC): This is the biggest activity in terms of data collection. PHC is conducted every ten years, most recently in 2012. NISR is planning to conduct an inter-census survey in 2017 to update the 2012 PHC.

Currently, the data from EICV and PHC is available only at district level. Considering the vision of GoR for the development of secondary cities, obtaining data at the municipal level is essential. For example, the definition of the characteristics of a new sanitation system for a secondary city should be based on reliable and accurate data. If precise data is not available, there is a risk that the technology selected will not be enough to meet needs and thus will be inefficient.

The **Rwanda National Land Use and Development Master Plan** defines the urban boundaries of secondary cities. Therefore, these areas should be used as geographic entities associated with secondary cities for specific data collection. Additionally, the integration of new indicators related to green growth will provide guidance on the monitoring of the sustainability level of secondary cities throughout their development.



Strategy 2: ***Adopt a spatial structure strategy and anticipate urban land needs***

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.

In general terms, there exist only three spatial structure models:

- The **monocentric city**: jobs and services are concentrated in the city centre – requires long transit for residents to get access to employment.

- The **polycentric city**: jobs and services are less concentrated in the city centre and there are subcenters providing economic activities – private or small-scale public transport dominates.
- The **'urban villages'** city: decentralized model based on harmonious space and transport relationship, because it does not automatically lead to self-contained communities with local residences and work places – transit to a city centre is still required but village centres also provide economic opportunities.

Urban structure is important: the spatial model selected for urban growth has an impact on densities and traffic generation directly impacting the environmental and economic performance of a city. The selection of an urban structure for the development of secondary cities is the first step for green growth and sustainable urbanization. This structure has to be adapted to the physical and historical context of a territory (e.g. each city has its own history, its own settlement patterns and is affected by a particular geography), and has to be a central element of urban planning tools.

Once a prospective spatial structure is identified, anticipating land requirements over a 30-year period provides guidance for urbanization patterns and the needs of the population in terms of infrastructure and equipment. Identifying the land needed for urbanization is based on demographic projections, population densities to be achieved, and growth pattern. Land requirements should consider both built and un-built areas, open spaces, and land for infrastructure and public equipment (sanitation, waste management, airport, cemeteries, etc.).

Land needs depend on density trends and both political and technical decisions. Using the average density combined with population and housing trends, is a way to estimate land needs. Taking into account the population growth rate, the size of the average family, and the average desired size of a dwelling, it is possible to calculate the amount of residential floor area required. Using a FAR and adding the area needed for other activities therefore makes it possible to translate these floor requirements into hectare requirements. The land requirements presented in the previous section for the secondary cities were established based on this methodology.

The UN-Habitat guide⁵ “**Urban Planning for City Leaders**” provides technical guidance on how to evaluate urban land needs for the prospective growth of a city. This methodology should be used in order to evaluate the specific needs of each secondary city and revise its planning documents accordingly.



Strategy 3:

Preserve ecosystems and biodiversity

Biodiversity refers to the variation of all life on earth. The natural habitats situated in cities are often viewed as being less important than those situated in the corresponding surrounding rural areas. Cities stereotypically have built settlements in close proximity to each other, which in turn has modified the natural land that once existed; and are frequently located in areas where biodiversity resources are concentrated, such as on rivers, hilltops and along lakes.

In some cases, ecosystems have been altered by urbanization and have lost their ability to support the diversity of natural life as they once did (irreversible environmental damage). In other cases – through protection – they continue to support the remnants of the surrounding countryside that have been incorporated into the urban environment.

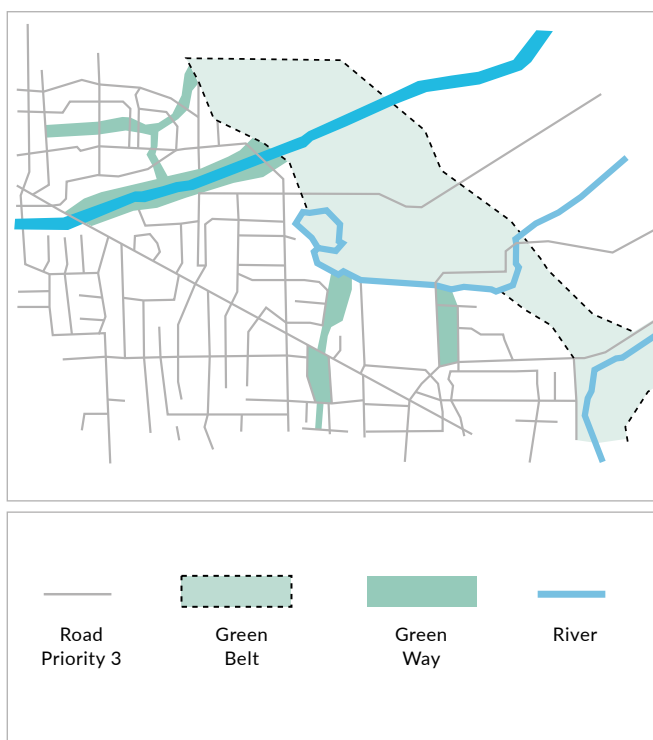
The variety of services that requires the overlooking of use of natural resources from the environment to support the functioning of cities is extensive and includes: climate regulation, water supply, erosion control, soil formation, food production, pollination of fruits and vegetables, and raw material supply. To add, there is a long-held misconception in disregarding the environmental aspects when the urban setting is considered, when actually they should go hand-in-hand. There are different ways to protect and preserve ecosystems and promote urban biodiversity, which the development of secondary cities can take into account.

Firstly, valuable ecosystems should be identified based on an environmental assessment of secondary city areas. Ecosystems of great value should be protected along with having their land boundaries well defined and incorporated into urban planning tools.

Another way to preserve and sustain ecosystems in secondary cities is to plan for green belts and greenways. These can directly or indirectly contribute to supporting biodiversity objectives by providing and maintaining connected open spaces in areas of urban development. These green designations should align with the natural features to adequately protect biodiversity that has the greatest value. These would generally be large features such as river corridors, woodland and other substantial tracts of semi-natural habitat.

Secondly, these green belts, greenways and green fingers should be connected to one another by preserving existing links or creating additional linkages in the landscape.

**FIGURE 9:
EXAMPLE OF GREEN BELTS AND GREENWAYS**



In addition to protecting and maintaining existing features and habitats of value, urban planning documents should identify potential connecting corridors in order to enhance the ecological value of secondary cities. Preparing for growth means identifying areas to direct urban growth towards and ensuring it steers away from natural heritage areas.

Strategy 4: Promote density

Urban sustainability increases with densely compacted cities. Dense cities tend to be greener (less GHG generated per person), more productive (economies of scale and of agglomeration benefits) and attract more talent and private capital.

Compact cities with higher-density are more energy-efficient and reduce the energy footprint to a greater degree than lower-density sprawling landscapes. This is because higher-density areas need less resources per capita for the provision and consumption of public services, such as less water piping and fewer electricity cables. In other words, higher urban density is associated with lower capital costs per capita in terms of infrastructure provision. As shown on the next page, a World Bank study found that higher density is a sound economic choice for urban development. For example, at a density of 5,000 inhabitants per km², the per capita cost of a bundle of infrastructure services (water, energy, sanitation and transport) averages \$660. At a density of 10,000 inhabitants per km² the average cost per capita falls by a third.

Density takes multiple forms and is not necessarily related to high-rise buildings. The key to higher density is to provide an urban environment where the user doesn't feel oppressed by the built environment. Therefore the quantity of open spaces, plot sizes, building types, and the number of household members, all have an impact on the perceived density.

Compact neighbourhoods also lead to mixed housing typologies and attract mixed income groups: a social objective that facilitates more inclusive development. Currently, various cities in Europe, Americas, as well as in Asia have set their course to become green cities and have prioritized compact development.

Per-capita carbon emissions are lower as long as efficient and attractive public transport is provided. Urban density can be controversial. Notably, in the absence of traffic management, compact cities may lead to congestion and to higher average temperatures as a result of the 'urban heat island effect'. In addition, per capita carbon emissions are reduced further with the basic facility of having a walkable city.

Urban density may also lead to increased land prices (especially if land controls and building heights are too strict) and can be associated with urban problems (loss of green space, crime and violence, vulnerability to natural disasters). Also, urban high density can help preserve agricultural land and open spaces beyond its borders.

Nevertheless, the concept of density is specific to every culture. Tradition, history and lifestyles have a significant influence on what acceptable density patterns are. What is considered to be high density in Rwanda might be considered low density for Korea. Therefore it is important to ask: what is a good density level for Rwanda's secondary cities? This concept is discussed in the text box below. All in all, densification plays a crucial role in the improvement of the health of our planet when properly planned.

Despite this, the public sector can favour or discourage densification or sprawl. Through strategic decision-

making with regard to transport and regulation of density (for example, with zoning and FAR limits) a district could guide the actions of the real estate market. Additionally, by controlling plot coverage, maximum heights, setbacks, and green spaces, a district has a direct impact on real estate development and therefore on the urban density of new neighbourhoods. However, if standards set are too high and affordable housing is not financially feasible, then people will be forced to seek housing solutions in the informal sector. As such, despite the legitimate goal of regulating density through plot size, many standards are difficult to apply to poor households. As a trade-off, they may opt to escape standards that are too high for them by moving into informal settlements that are closer to job opportunities.

On this basis, it is recommended that urban regulations be tested using land and infrastructure price models in order to establish the minimum household income required to afford a minimum standard plot in a new neighbourhood.

**TABLE 7:
CAPITAL COSTS FOR INFRASTRUCTURE PROVISION BY DENSITY**

AFRICAN CITIES: CAPITAL COST PER CAPITA FOR INFRASTRUCTURE PROVISION BY DENSITY (\$US PER CAPITA)							
Density per km ²	30,000	20,000	10,000	5,000	3,000	1,400	1,200
WATER							
Private Tap	104	124	169	323	294	416	449
Stand Post	31	36	49	66	82	116	125
Borehole	21	21	21	21	21	21	21
Hand Pump	8.3	21	21	21	21	21	21
SANITATION							
Septic Tank	125	125	125	125	125	125	125
Improved Latrine	57	57	57	57	57	57	57
Unimproved Latrine	39	39	39	39	39	39	39
ENERGY							
On-Grid	64	71	89	113	137	184	197
Minigrid	88	95	113	137	161	208	221
Solar	92	92	92	92	92	92	92
Roads	24	35	71	141	234	486	567
ICT	1.1	1.7	3.3	6.6	10.9	22.8	26.6
TOTAL	325	369	480	665	879	1031	1061

Source: The World Bank

What defines “good density” for a Rwandan city?



In general, density is largely driven by topographical constraints, the location of public transport and other infrastructure, but also by a city’s inherited traditions of urban culture and development.

In Rwanda, the lack of written sources about the local urbanization process could be seen as an obstacle, but culture does not only come from texts. Landscape, climate, oral traditions, craftsmanship, and history have shaped today’s Rwandan society. Years of practical knowledge and family history explain the way the land has been divided and the way paths are conceived. In order to get the density right in prospective city developments, it is important to consider that Rwanda has shaped its environment based on cultural tradition, and using this millenary knowledge in order to define urban patterns in new cities and neighbourhoods is essential.

Rwanda means “the infinite land”. The country is a succession of hills dividing and uniting the landscape. Because the hill line cuts the horizon, a sense of closeness, of belonging to one place has been developed and is part of the culture. Since the landscape is repeated, Rwandans also feel that they belong to something larger. This duality has deeply shaped the Rwandan sense of place and belonging.

On the other hand, Kigali means, “wide view”. From mount Kigali one can see the entire country; as far as Lake Kivu. This strategic position in the middle of the infinite land could explain the historical importance of Kigali, the place where you have many vistas in order to control the land. Also, Kigali is made of numerous viewpoints letting the great landscape of Rwanda feel part of the city. In Rwanda, each urban entity is linked to the other, no matter its scale; yet these entities are developing their own individual identities and sense of place. The meanings of the words “Rwanda” and “Kigali” are both as much descriptive as programmatic. The landscape and the natural environment are essential components of the Rwandan psyche and they have to be taken into account in any urban planning process.

There is an urban identity that lies deep in Rwandan history, equally manifested in Kigali. Urban history itself is recent, and people are not used to urban density, even though no place in Rwanda is uninhabited. This explains why in Rwanda – probably more than elsewhere in Africa – urban density has to be paired with strong integration of nature. Design of new neighbourhoods and new cities with higher densities has to be compatible with public open space, the integration of greenery, and views.

Strategy 5: **Promote mixed land use**

Successful planning of mixed land use, including residential, commercial and industrial, positively influences urban sustainability. The encouragement of mixed land use, both vertically and horizontally, allows a range of benefits to develop:

Social benefits:

- Improves accessibility to goods and services, and to urban amenities for a wider variety of the population.
- Enhances the perceived public safety of an area by increasing the number of people on the streets and public spaces.

Economic benefits:

- Increases potential opportunities for business and trade as multiple activities attract more potential customers during more hours of the day.
- Increases housing options available to urban dwellers.
- Reducing the overall demand for transport, reducing average trip lengths and the use of cars.
- Reducing the demand and cost for providing infrastructure services, as a smaller proportion of land is used by a larger number of users.
- Helps to minimize the amount of land allocated for parking and provides a greater base for public transport, walking and biking.

Creating mixed-use neighbourhoods is not a new approach, it is a fundamental for urban agglomerations, and has always been a standard even before cars entered into our lives. Promoting mixed land use also implies promoting a city with more equal opportunities between low and high-income groups and greater opportunities for civic interaction and social integration.

In particular, the new District Land-Use Plans (DLUP) for secondary cities districts specify that mixed housing has to be provided in any new area in order to provide opportunities for all income groups to settle. The model neighbourhood proposed by the revised DLUP indicates

that a developing area should be divided into 3 parts: 25% for high income, 25% for medium income group and 50% for the low-income group.

UN-Habitat's 'Urban Planning for City Leaders' guide indicates that in order to support a mixed-use city, at least 40% of the floor area of a territory should be allocated for economic uses. Consequently, monofunctional zoning (such as residential-only neighbourhoods) should be reduced to no more than 10-15% of the overall land.

Strategy 6: **Integrate transport and land development**

Urban transport is a central pillar of urbanization as it allows connectivity of new areas to the existing road network. The road networks in cities evolve as people try to connect houses, businesses and other infrastructure to existing roads. The synergies between transport and land development are evident. Therefore, an integrated and holistic planning process integrating transport and spatial development is a central component of green growth. In particular, urban patterns, the density and the diversity of land uses, will have a direct impact on the demand for transport, and consequently congestion and levels of GHG emissions. A well-executed spatial development plan incorporating smart growth designs means that motorized travel can be largely forgone. For example, the provision of higher densities supports the development of an efficient mass transit system, as enough people can sustain such a system.

Spatial development and transport interact in a way that is central to green growth. Planning with these two components in-mind facilitates the achievement of objectives relating to sustainability, such as: land consumption, GHG emission, economic productivity, and infrastructure efficiency.

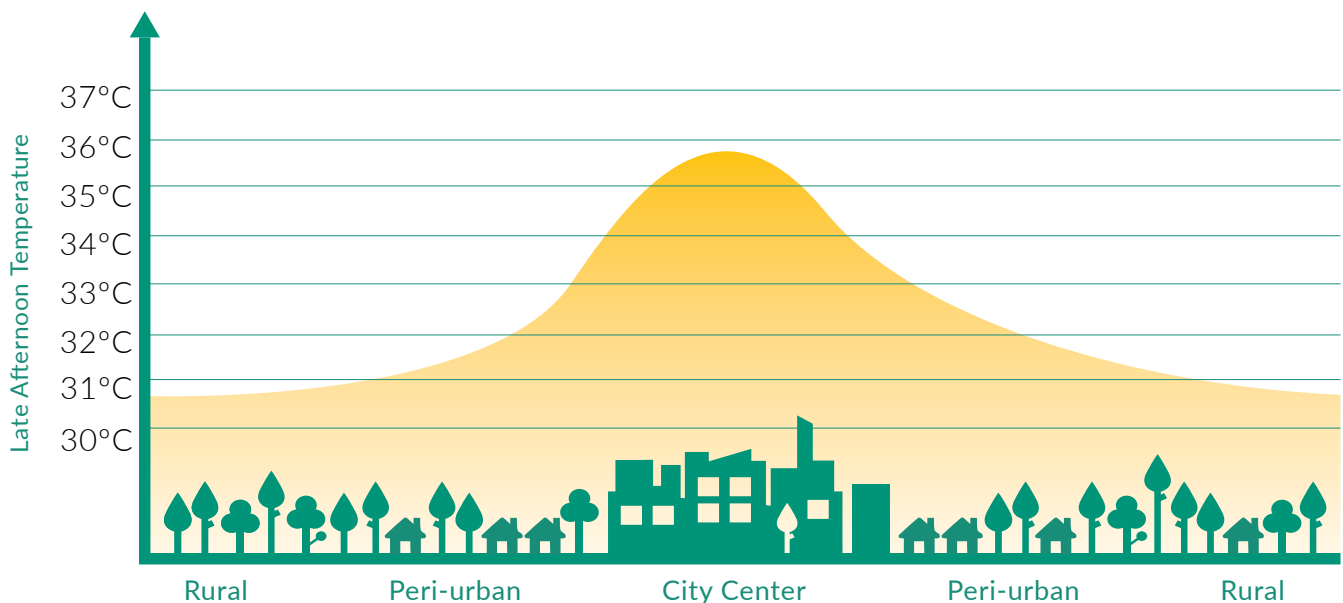
Transit-oriented design is a planning strategy that must be integrated in the planning process for secondary cities. Transit-oriented design is focused on developing new neighbourhoods that fit around public transport infrastructure, such as bus routes or a Bus Rapid Transit (BRT) system.

Green transport modes, such as public transport and non-motorized transport (such as walking and cycle routes) define land use patterns, and help to achieve spatial development that maximizes the density and the diversity of the urban environment.

Strategy 7:
Plan sufficient green spaces

Urban green spaces provide multiple benefits: they improve the quality of the air and water, reduce energy consumption and help mitigate GHG emissions. Trees planted in these green spaces consume carbon dioxide emitted in the atmosphere and consume water which reduces the risk of flooding from heavy rain storms. In turn green spaces and trees can help increase land value and quality of life of inhabitants. The more dense a city is the more energy is consumed in various forms (such as cooking, heating and car fumes), and therefore more heat is emitted increasing the air temperatures above the city. In addition, the concentration of pavement and concrete adds to this by trapping and containing the natural heat emitting from the environment. Together, these factors cause the 'urban heat island effect' shown in Figure 10 below. Trees and green spaces are essential in directly reducing this urban heat island effect.

FIGURE 10:
URBAN HEAT ISLAND EFFECT



Creating green spaces in an already developed area requires a complex expropriation program, which can be expensive. Planning ahead of urban growth saves public money and provides a healthy foundation for a city to be sustainable and resilient.

Green space can take the form of areas which are accessible to the public, areas that are the private beholder of the land holder (such as private garden), or areas that are protected and preserved, and are thus not publicly accessible. In order to fully embrace the optimal benefits of green spaces, it is necessary that public access to these areas in the city is encouraged. The **World Health Organization (WHO)** suggested that every city should have a minimum of 9 square meters of green space per person. As previously discussed, higher urban density in Rwanda has to be paired with higher integration with the environment. Consequently, the planning process and the development of secondary cities must at the minimum meet the WHO requirement, but ideally exceed this threshold.

Table 8 on the next page shows the minimum amount of space that should be devoted to green spaces in secondary cities. The figure shows the amount of space required based on the current urban population and the projected population for 2020. The quantity of space reflects the WHO standard, but also shows the recommended 15 square meter per person standard; based on specific cultural context of Rwanda.

**TABLE 8:
GREEN SPACE REQUIREMENTS FOR SECONDARY CITIES**

CITY	HUYE		MUHANGA		NYAGATARE		RUBAVU		MUSANZE		RUSIZI	
	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020
Urban Population	52,768	103,654	50,608	111,901	47,480	181,600	149,209	421,124	102,082	236,638	63,258	137,315
WHO Standard (9 m ² / person)	47.5 Ha	93.3 Ha	45.5 Ha	100.7 Ha	42.7 Ha	163.4 Ha	134.3 Ha	379 Ha	91.9 Ha	213 Ha	56.9 Ha	123.6 Ha
Suggested Standard for Rwanda (15 m ² / person)	79.2 Ha	155.5 Ha	75.9 Ha	167.9 Ha	17.2 Ha	272.4 Ha	223.8 Ha	631.7 Ha	153.1 Ha	355 Ha	94.9 Ha	206 Ha



Strategy 8:

Design efficient and pedestrian-friendly streets

Streets are the veins of a city. In general, 20%-30% of a city's developed land is likely to be dedicated to road infrastructure. Streets define the urban pattern of a city, and carry the infrastructure and utilities needed for urbanization. In turn, the design of streets has a direct impact on the way inhabitants interact with the space and commute from one point to the other.

The street is an important public space and its design should be coherent with provisions on density and land use. Sufficient space for circulation, public interaction and the laying of infrastructure has to also be considered. In addition, streets cannot be too large as they can have a negative impact on urban vitality along with affecting the behavior of drivers within that area.

Based on UN-Habitat's guide 'Urban Planning for City Leaders', it is possible to highlight the basic components of a high-quality street:

- Pavements wide enough to accommodate all users,
- Enough crossing points in the right strategic places
- Traffic levels that are not excessive
- Public spaces along the street
- Good lighting
- Signage, landmarks and good sight lines
- Sense of security

- High standards of maintenance
- Smooth, clean, well-drained surfaces

The street grid should be a strategic component of any urban planning process. When planning extensions, the arterial and street grids are highly effective in guiding growth.

A planned grid with arterial roads spaced no more than one-kilometer apart give access to public transport within a 10-minute walking space, and a smaller grid of streets ensures that block size is to human-scale.

Considering the projected growth of secondary cities, urban expansion is obvious. Thus, the planning of a street grid based on human-scale and urban expansion is essential, and should be a priority of urban designers of new neighbourhoods.



Strategy 9:

Mainstream gender perspective in city planning

Cities belong to both women and men. Active citizenship begins at the cell, the sector, and the district level. The way a city is planned, designed and governed must permit both women and men to fully exercise their citizenship, be active members of the community and conduct their daily activities. The design of urban infrastructure (such as roads, public places, parks, bus stops, water point and waste collection points) is critical and must integrate a woman's perspective.

Equality of all Rwandans is one of the fundamental principles of the **National Constitution** (article 9). The constitutional framework provides quotas (at least 30%) for women in decision making, which have resulted in an unprecedented number of women being elected or appointed to decision making positions at all levels, from the central level up until the cell level.

In addition, the GoR has put in place a specific ministry in charge of gender equality and family promotion, the ministry adopted a **National Gender Policy**, which ensures that gender is mainstreamed across all sectors of EDPRS 2. The Ministry of Gender and Family Promotion (MIGEPROF) works closely with the Ministry of Local Government (MINALOC) in order to facilitate and coordinate gender-mainstreaming initiatives at the district level. In particular, this translates into the integration of gender concerns in DDPs and the development of gender budget statements.

The GoR also established an office to monitor and evaluate the implementation of the gender policy at all levels.

Long confined to domestic activities, women have gradually moved into the public arena and therefore the urban setting must adapt to this cultural change. In rapidly growing cities, the development of new neighborhoods must deal with the realities and the perspective of women. Traditionally, women have multiple responsibilities, such as providing food and water, maintaining a household, and caring for their children, elders and sick family members. Without facilitating and accommodating women's activities, which are typically more varied than men's, a city will not grow or develop.

City planning has normally been conducted with a gender-neutral approach: "whatever is good for men is automatically good for women". However, this is a misconception and does not reflect reality. It conceals the specific needs of men and women and prevents one from detecting and rectifying persistent inequalities with regard to urban design.

Improving the quality of life of women living in urban areas is an international concern. Notably, in 1996 the **United Nations' Conference on Human Settlements (Habitat II)**, prompted member states to make commitments to a common goal in the framework of its **Habitat Agenda: achieving equality between men and women in the management of human institutions within cities and communities.**

For tangible action, the development of a women-friendly city means a complete paradigm shift in the ways the urban setting is planned. Responding to the different needs of women in the design and management of the urban environment requires adopting a new perspectives, perhaps even increasing the inclusion of women during the planning process. It is therefore crucial to take into account what women in other developing countries have been excluded from urban life and make sure appropriate safety nets are available, which in turn have to be included in urban planning.

Women's exclusions with regard to the urban setting typically include⁶: (i) assets for livelihoods and basic services, (ii) right to own land, inherit property, and have security of tenure, (iii) access to employment and equal wages, (iv) safety, (v) decision making, and (vi) services related to child care, education and sexual and reproductive health. Therefore, there is great potential for urban planning to include measures avoiding these exclusions through "municipal governance, spatial organization, infrastructure, and services to better serve women".

In Rwanda, a first step consists of integrating a women's perspective in the development of existing master plans and local land development plans. A good way to facilitate this process is to refer to the existing district's Women Council for every urban planning activity.

For example, if a master plan or a local land development plan is being revised, the Council has to be consulted and provide its guidance on a gender perspective. The same approach should occur for any large urban project that occur in the city.

⁶ UN-Habitat. Urban Planning and Design - Gender issue guide. Nairobi, 2012.

In 2011 the National Women Council of Musanze which is represented in the District Council advocated for putting in place public lights in the road located in Muhoza sector in the city of Musanze because of its high level of danger, and its specific lack of safety for women. Also in 2014 the National Women Council advocated for women street vendors to have a market where they can sell their products to avoid high risks of abuse or other accidents. The market has successfully been built and is now operational in Musanze.

In addition, the adoption of a new perspective on city development by district technicians through direct training and sensitization is critical. Taking a new perspective that breaks with the traditional - supposedly gender neutral - planning approach allows the planning process to understand the distinct local realities and needs of women and men. The goal of a gender perspective in urban planning helps eliminate causes and manifestations of inequality between men and women. The development of a gender perspective in urban planning and the development of guidelines for women friendly initiatives should be part of the work undertaken by the Gender Reference Group, a forum established by the Gender Monitoring Office to promote dialogue, consultation and information sharing.

In terms of city development, adopting a gender perspective could be translated into very tangible guidelines:

- Development of women friendly roads with improved brightness of lighting to more than 30 lux over sidewalks
- Improvement of the brightness of lights at locations frequented by women (water point, waste collection points, bus stops, etc.)
- Installation of CCTV in strategic locations (markets, commercial areas, schools, etc.)
- Redevelopment of public spaces that have multiple hiding places
- Increase walking friendly pavements within the city, which helps the use of strollers too
- Creation of women-friendly bathroom in public spaces (minimum 1:1 ratio of men's toilets to women's; installation of diaper changing tables and baby chair, and access to clean water)
- Implementation of a "between two stops" bus drop-off program at night

- Increase access to public transport, where it should be safe, reliable, frequent and affordable

Finally, another way to adopt a gender perspective in city planning is to conduct **safety workshops on the ground** with district technicians, security officials, women, young people and children. Such workshops, realized under the leadership of the Gender Monitoring Office should help identify the direct factors that create risk and insecurity in the urban environment.

Strategy 10: **Plan a resilient city**

Urban resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. In general, urban resilience focuses on the threat of climate change that enhances the already pronounced natural disasters the area experiences. In recent years, the disaster risk profile of Rwanda has increased, resulting in more intense and frequent natural hazards, such as floods and landslides. Existing climate variability, manifested mainly in periodic floods and droughts, not only because of land use pressure, or the hilly land that is highly exposed to risk of degradation and erosion as a consequence of floods and rain, or the desertification trend, but also because of rapid population growth.

Natural disasters in Rwanda not only have significant impacts on the environment but also on economic growth, livelihoods and food security. Droughts in Rwanda are mainly prominent in the south east region where none of the secondary cities are situated, therefore flood and landslides are the two main types of disasters that directly affect the secondary cities.

In order to cope with natural disasters, GoR has created a Disaster Management Policy, Disaster Management Law, National Platform for Disaster Risk Reduction (DRR), and mainstreamed DRR into EDPRS 2 in order to tackle natural disasters.

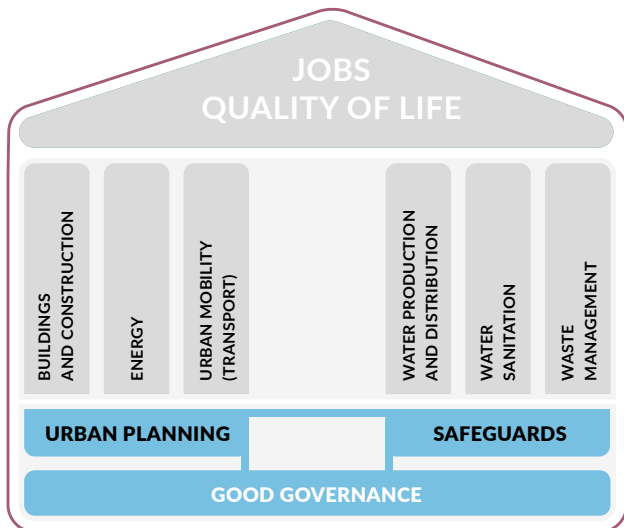
The projections of future climate change for Rwanda point to a trend of warmer and wetter climate. The Green Growth and Climate Resilience National Strategy indicates that all models predict an increment in mean temperature, and the majority of models predict increases in annual rainfall totals. Consequently, climate change could lead to annual economic costs equivalent to 1% of GDP by 2030. As such, Rwanda also needs to better understand the implications of current and future climate change impacts in order to facilitate greater design and planning of the required adaptation measures.

In the context of the secondary cities, urban resilience means preventing disasters, and planning ahead in order to cope with them in an efficient way.

The planning of urban extensions of secondary cities should take into account **adaptation to climate change**, which includes providing infrastructure that is able to accommodate stronger rain episodes, provide a canopy that could help to reduce the heat-island effect associated with higher temperature in central locations, avoid construction on steep slopes or in areas subject to flooding.

Additionally, considering urban sprawl is largely characterized by the formation of informal settlements on hilly areas at the edge of city centres, particularly in Rubavu, urban renewal projects should be undertaken in the already-built climate-change sensitive zones of secondary cities.





Below is an indicative list of safeguard standards that are typically considered.

Environmental safeguards:

How city development will consider impacts on the environment such as biodiversity and natural habitat; pollution to land, water and air including greenhouse gas emissions linked to climate change; hazardous and toxic materials; and public health.

Social safeguards:

How city development will consider social aspects related to equal access to basic services such as energy, water and sanitation; the rights of indigenous peoples and vulnerable groups; gender equality; and involuntary resettlement. The National Gender Policy identifies the need to ‘facilitate and support women’s and men’s participation in environmental protection and management.

Article 67 of the Organic Law No. 04/2005 of 08/04/2005 on Determining the Modalities of Protection, Conservation and Promotion of the Environment of Rwanda requires that projects, programmes and policies that affect the environment shall be subjected to environmental impact assessment before authorization for implementation. This provision is expected to cover most environmental safeguard considerations.

Environmental and social safeguards are considered throughout the NR and in the already mentioned foundation of urban planning. One crucial social safeguard to address in more detail when considering urbanization is involuntary resettlement.

4.3 Safeguards

Vision 2020 calls for a well regulated environmental management system that takes into account principles of sustainable development and at the same time poverty alleviation.

Applying environmental and social safeguards into city development will ensure that the environment is preserved and people’s well-being is considered from the start. Through identifying and managing environmental and social risks and opportunities, this process will support the goal to reduce poverty and increase prosperity in a sustainable manner for the benefit of both the environment and people.

The application of safeguards in green city development will:

- Support cities in achieving good international practice relating to environmental and social sustainability;
- Assist cities in avoiding potential adverse impacts on the environment and people from development activities;
- Help minimize, mitigate and/or compensate for adverse impacts on the environment and affected people when avoidance is not possible;
- Enhance non-discrimination, transparency, participation, accountability and governance;
- Enhance the sustainable development outcomes of city development through ongoing stakeholder engagement.



Strategy 1: **Manage resettlement responsibly**

Secondary city development may give rise to involuntary resettlement which may cause long-term hardship, impoverishment, and environmental damage unless appropriate measures are carefully planned and carried out.

For these reasons, it is suggested that responsible resettlement principles⁷ listed below are adhered to where possible:

- Involuntary resettlement should be avoided
- Where involuntary resettlement is unavoidable, all people affected by it should be compensated fully and fairly for lost assets
- Involuntary resettlement should be conceived as an opportunity for improving the livelihoods of the affected people and undertaken accordingly
- All people affected by involuntary resettlement should be consulted and involved in resettlement planning to ensure that the mitigation of adverse effects as well as the benefits of resettlement are appropriate and sustainable

When resettlement is unavoidable during city development, resettlement plan or a resettlement policy framework should be prepared ensuring that the displaced persons are:

- Informed about their options and rights pertaining to resettlement
- Consulted on, offered choices among, and provided with technically and economically feasible resettlement alternatives
- Provided prompt and effective compensation at full replacement cost for losses of assets attributable directly to the development

If the impacts include physical relocation, the **resettlement plan** or resettlement policy framework includes measures to ensure that the displaced persons are:

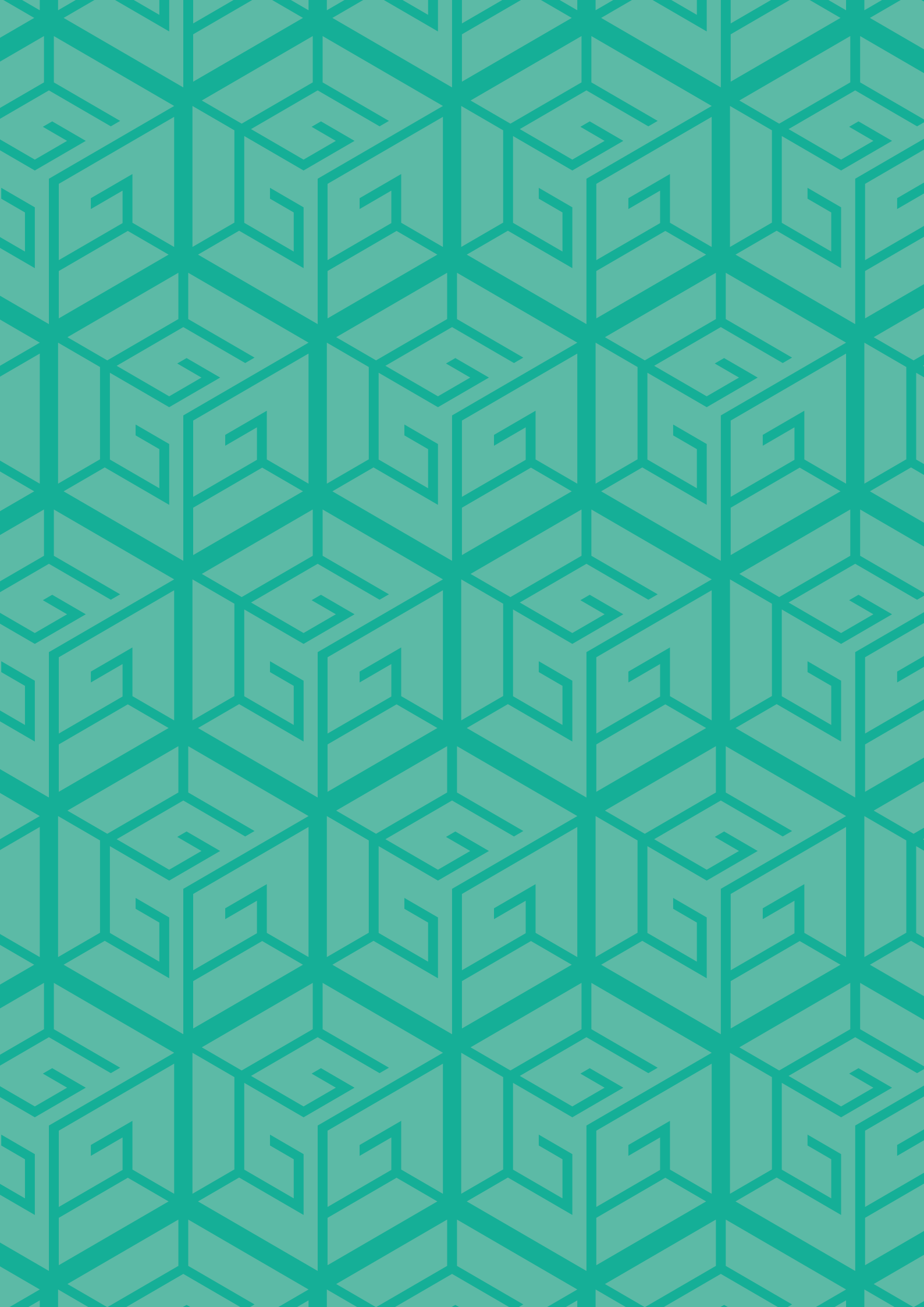
- Provided assistance (such as moving allowances) during relocation
- Provided with residential housing, or housing sites, or, as required, agricultural sites for which a combination of productive potential, locational advantages, and other factors is at least equivalent to the advantages of the old site

Where necessary, the **resettlement plan** or resettlement policy framework should also include measures to ensure that displaced persons are:

- Offered support after displacement, for a transition period, based on a reasonable estimate of the time likely to be needed to restore their livelihood and standards of living;
- Provided with development assistance in addition to compensation measures such as land preparation, credit facilities, training, or job opportunities

Particular attention may need to be directed to **vulnerable groups** among those displaced, especially those below the poverty line, the landless, the elderly, women and children, indigenous peoples, ethnic minorities, or other displaced persons who may not be protected through national land compensation legislation.

⁷ Adapted from World Bank Operational Manual (Op 4.12) on Involuntary Resettlement.





5. Pillars of green urbanization

The pillars of green urbanization are sustained and successful from the enabling characteristics of the foundations. Green urbanization is the process of the population moving from rural to urban areas, where the negative associations to urbanization (urban sprawl, informal settlements, inefficient public services, and traffic and congestion) are sustainably prevented to account for poverty alleviation and the protection and preservation of the environment.

The pillars of green urbanization are:

- **Building and construction**
- **Energy production and consumption**
- **Urban mobility**
- **Water production and distribution**
- **Water sanitation**
- **Waste management**

In order to achieve green cities, and thus ensure the long-term survival of the urban environment, action is required in each pillar.

This chapter of the NR provides guidance for the investments required in each of the pillars. The focus on growth has to be balanced with a concern for sustainability and resiliency. While cities can prosper they can simultaneously generate environmental and resource challenges and thereby urban difficulties. The guidance can help with strategic planning and in turn with the integration of different investment priorities from the pillars. In addition, cities offer the enabling environment and opportunities required to further prosper towards green growth, which in turn provides a multiplier effect of benefits towards the city's surrounding rural or peri urban areas.

For each pillar, this chapter provides an analysis of in a green growth perspective, a review of international standards, and an analysis of the current situation in Rwanda and secondary cities. Also a preliminary estimate of the prospective needs for secondary cities is provided. This analysis leads to green development guidelines that are specified to guide and monitor public and private investments in secondary cities.

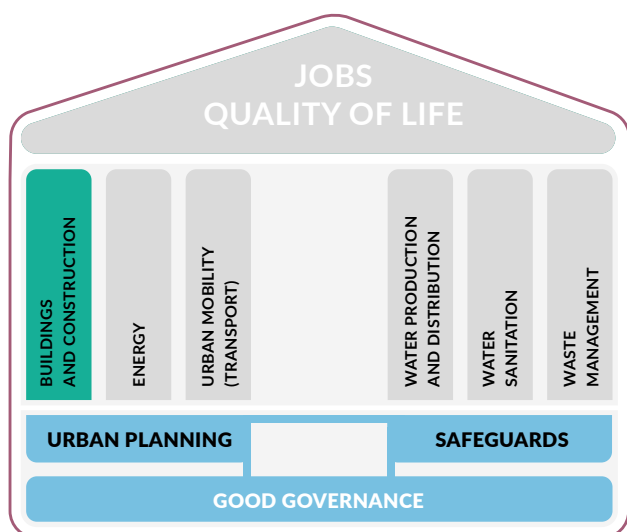
Based on best international practices, the green guidelines are followed by tangible actions adapted to the Rwandan context.

These guidelines are elaborated in the context of the secondary cities and could also provide guidance for the broader context of urbanization of Rwanda or other fast urbanizing nations of Africa.

Finally, this section identifies cross-cutting issues and addresses the roles and responsibilities of ministries, agencies and development partners for each pillar. Urbanization is a complex phenomenon and it involves multiple stakeholders; the aim of the NR is to simplify and improve the coherence of public and private action behind the development of secondary cities in Rwanda.

Women are key stakeholders in this process, and their specific needs in communities, along with those of men and children need to be met in addressing all six pillars as women are the traditional family member responsible for obtaining and using household energy and water, household sanitation and waste management. Women also have specific family and productive needs in mobility and buildings to access schools, markets and recreational areas for children using transport that is safe and reliable.





5.1 Building and construction

Green urbanization of the six secondary cities entails efficient preparations to accommodate the migrating population: providing living habitation (residential), employment space (industrial) and services (commercial) space.

The building sector is a key economic driver. Green construction offers an opportunity for job creation, improved quality of life, and decreased impact on the environment. The development of secondary cities implies construction of new buildings.

As such, an emphasis towards greater resource efficiency, use of locally sourced material, and improved construction techniques in accordance with the Rwandan context is strategic decision and has a significant impact on green urbanization.

Green building design and construction provide an opportunity to use resources more efficiently, while creating healthier and more energy-efficient homes and commercial buildings. Successful green buildings leave a lighter footprint on the environment through conservation of resources, while at the same time balancing energy-efficient, cost-effective, low-maintenance products for construction needs.

As indicated in the urban planning section, settlement building planning usually takes the form of compact cities for urban areas. This encourages walking, cycling, and reduces the distance to services, which in turn reduces the need to use polluting vehicles for travel and encourages the use of public transport. In addition, as discussed previously, one has to account for the Urban Heat Island (UHI) effect: A heat island is an umbrella of air, often over a city or built-up area, that is warmer than the surrounding air⁸.

This is more intense over denser urban areas due to high human consumption activities, especially within buildings, and can be reduced with parks and other vegetated sections. Research has found that compact development contributes less heat energy to the surrounding air than low-density dispersed growth patterns⁹. The early development stage of Rwanda's secondary cities creates a unique advantage to account for such potential problems through green buildings.

Design and construction of green buildings for sustaining the target of 35% urbanization by 2020 gives scope for resource savings through: reduced energy costs; better functionality increasing building sustainability; and preserving the value of green areas and cultural heritage sites. This, in turn, contributes to green growth.

Achieving these outcomes is dependent upon the following:

- Building design for optimum use of natural resources such as sunlight and wind
- Materials used for construction to be produced at low emissions levels and to be sustainable to resist extreme climatic conditions i.e. 'climate-smart'
- Energy efficiency measures into buildings to facilitate more efficient consumption

As shown in figure 11 on the next page, green guidelines can be distinguished for both building construction and building consumption, with regard to the three dependencies stated above. Therefore, these guidelines will state the necessity boundaries when implementing the key actions identified in the NR to achieve the green

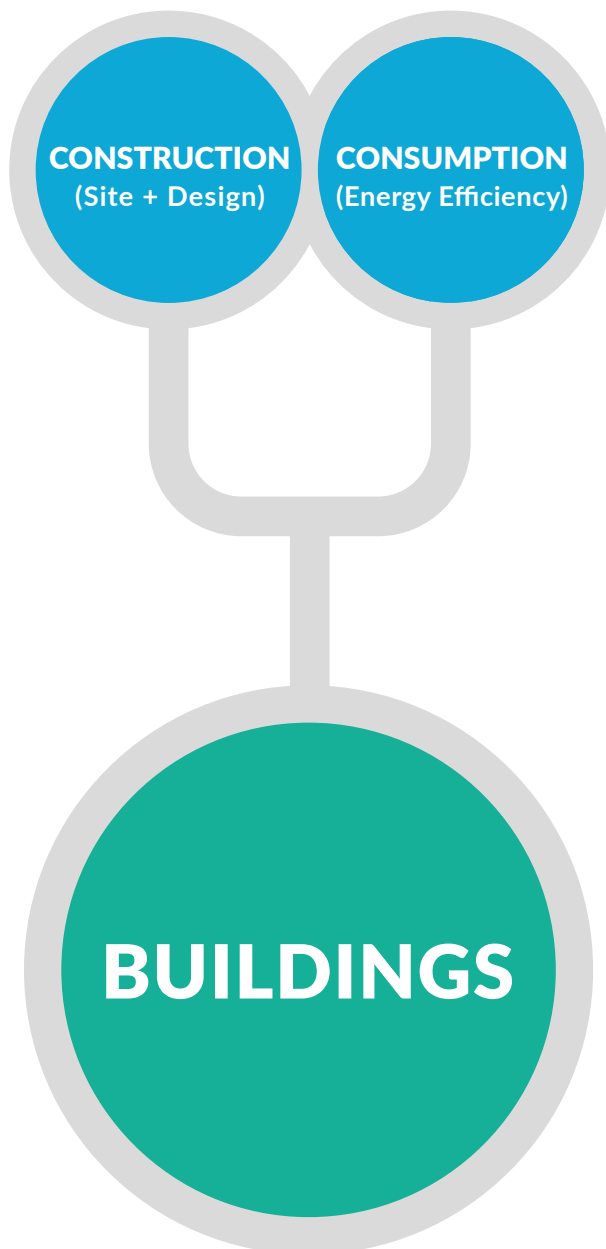
8 Environmental Protection Agency. Smart Growth Network – Smart Growth and Urban Heat Islands. Washington DC. <http://www.epa.gov/hiri/resources/pdf/smartgrowththeheatlands.pdf>

9 Stone, B., and M.O. Rodgers. 2001. "Urban Form and Thermal Efficiency: How the Design of Cities Influences the Urban Heat Island Effect." *Journal of the American Planning Association* 67 (2) 186-198.

guidelines, whilst taking into account the fact that Rwanda is a developing country with priorities of inclusive growth.

Prioritization of low-income groups is therefore an important factor to take into consideration when implementing, through the following key factors: ensuring the existence of affordable housing, constructing energy efficient settlements, and encouraging win-win scenarios.

**FIGURE 11:
GREEN BUILDING MARKET COMPOSITION**



5.1.1 Green growth and building

In terms of green growth, intervention in the building sector could take place on the **construction** side and on the **consumption** side.

Buildings construction

The production value chain of buildings typically gives rise to negative associations with the upkeep of the environment due to emissions from: extraction of materials; processing of building materials; transportation of materials; expropriating the grounds for building preparations; and destruction of the environment for building space; further damage of environment by the misuse of built areas; and low preservations methods of existing green areas of surrounding buildings. There are many opportunities to avoid these negative associations along the value chain.

“The building must be in accordance with the climate, and not the climate with the building¹⁰”. Buildings, in turn, present a simplified path to sustainable design which accounts for the sun path, prevailing winds, site topography and vegetation to achieve buildings that possess the following characteristics:

- **Building openings** – Accounting for humidity, solar radiation and ventilation from consumption.
- **Natural Ventilation** – Importance of the replacement of air for indoor comforts and hygiene. Differentiates cross ventilation and vertical ventilation¹¹.
- **Natural Lighting** – Reducing the need for artificial lighting inside the building during sun light hours through positioning of windows and the types of windows.

¹⁰ UN-Habitat. Promoting Energy Efficiency in Building in East Africa – Urban Energy Technical Note number 1, Figure 1 Eco building.

¹¹ “Cross ventilation depends on the building shape and wind speed/direction. Inlet openings should be regularly distributed, and allocated on the wind-ward side at a low level. The outlet windows should be allocated on the opposite side. The vertical ventilation is called “Stack effect” and is caused by the difference of temperature between inside (warmer) and outside air.” – Page 2 of Promoting Energy Efficiency in Building in East Africa – UN Habitat - Urban Energy Technical Note number 1

- **Roof** – Roof types utilized to avoid infiltration problems (sloped roof), decrease internal temperatures whilst purifying urban air (vegetated roof), and help vertical ventilation (roof openings).
- **Sun-Shading** – Importance of the overhangs for sun shading to control indoor temperatures.
- **Materials** – Building material to reflect and sustain an area’s climatic zone. Tropical highlands should favor high thermal mass (stone) materials, which store heat during the day and release it at night, and tropical humid lands should favor wood due low heat preservation. Building material should also be locally sourced.

Generally, nationally adapted design standards that deliver low carbon construction and subsequent zero and low carbon living, should set out options for construction materials for city development, including how these will be supplied, and the associated sustainable building standards.

In particular, this includes standards for energy efficiency, water use, and wider sustainable resource use, including those for materials. This would be applied to both new and existing housing and industrial and commercial development¹².

Rwanda’s secondary cities can therefore benefit from green buildings when their designs, and thus construction approaches, capture the above mentioned characteristics.

For Rwanda, building designs need to account for: the specific topography that each of the secondary city has, the two dominant seasons (the wet and dry), local sources of rich minerals for green materials, and means to recycle the scarce resources.

However, this all depends on the demand for settlements, and therefore, depends on the affordability of those settlements, especially when considering potential pools of low income urban dwellers.

12 Kigali Sustainable Urbanism Principles set out in the Kigali Sup Area Plan highlight the need for National Green Building Guidelines (Case study 1, chapter 2). World Bank (2012) Informal housing: Reducing disaster vulnerability through safer construction.

Building consumption

Over 70% of the world energy generation is consumed in human settlements, resulting in an emission of more than two thirds of CO₂ that contributes to climate change¹³. City buildings are typically the highest consumers of energy due to the higher density of human settlements and thus such buildings are the area with the highest contributions to Green House Gases (GHG) emissions. More specifically, urban density has a negative correlation with GHG emissions¹⁴ in terms of CO₂ per capita. Therefore, there is a great need to develop energy efficiency in buildings in the secondary cities, especially at the initial stages; to benefit from energy savings and pumping operations of water supply, especially to instill efficient consumer behavior.

To reap these benefits, technical innovations are needed in the following areas:

- **Lighting** – Energy saving light bulbs and automatic lights for public buildings
- **Renewable energy production** – Individual off-grid energy production, household solar panels, solar water heating
- **Water use** – Efficient water plumbing to avoid water loss, and rainwater harvesting to compensate scarcities of water supply
- **Consumer behavior** – Green labelling and certifications for public recognition and to influence mindsets of green initiatives

Targeting the technical innovations above for further developments will significantly contribute to the greening of building consumption whilst serving as a mainstreaming tool to change societal norms.

With a green foundation in place, this will in turn contribute and influence green sensitive actions from the beginning of any initiated production value chain.

13 UN-Habitat. Urban Energy Technical Note. Nairobi, 2013.

14 As per a cross-country analysis comparing per capita CO₂ and urban density has added evidence that the relation is robust and negative – David Dodman (2009).

5.1.2 National context of Rwanda with regard to green buildings

The **Rwanda Housing Authority (RHA)** is the agency responsible for urbanization, whose mandate includes responsibility for settlements and building construction.

RHA, jointly with **MININFRA**, have recently upgraded the **Rwanda Building Code**, which has incorporated green building recommendations made by the **Policy and Legal Framework for Energy Efficient Housing in Rwanda**. They include building mandates, which are then to be implemented for mainstreaming by the **One-Stop-Centres** of each district in Rwanda.

In addition, the **National Strategy for Climate Change and Low Carbon Development (NCCLCD)** provides strong guidelines for green buildings.

Action 1 of the National Strategy for Climate Change and Low Carbon Development (NCCLCD) for Low Carbon Urban Systems provides guidance on low energy buildings and services in Rwanda. Notably, the action indicates that the implementation of low energy standards in buildings and services in Rwanda could result in an 80% reduction in energy use over current global practice.

To this effect, the NCCLCD stipulates that the country will adopt a national low energy building standard, enshrined in the building code, to produce the necessary behavioral change in the industrial sector, without costly intervention in the sector by the state. These standards will be built around systems, such as passive housing principles that are technically appropriate, have minimal upfront costs, and little or no operational costs. Additionally, the recovery of grey water and rainwater should be inserted into the building code to support water efficiency and conservation.

The National Housing Policy (adopted in March 2015) states that building concepts shall adopt energy efficiency building standards, grey and rainwater recovery and ICT facilitation. Their actions include the following: develop energy efficient building standards; establish regulations for grey and rainwater recovery, water treatment, and waste management.

More specifically, on materials the National Housing Policy supports the use of local construction materials. Based on the Policy, emphasis should be on an increase of quantity of material produced in Rwanda, its quality, and on competitive costs of locally produced products.

In addition to government's initiative, the **Real Estate Association of Rwanda (REAR)** advocates for professionalism, business cooperation, and monitoring of a business code of conduct for its members. Moreover the Association offers capacity building workshops for REAR members and could become a key actor in green building promotion.

5.1.3 Prospective needs of secondary cities in terms of building construction

Using population projections estimated to achieve 35% urbanization by 2020 in Rwanda for each of the secondary cities, it is possible to estimate the required amount of buildings and more specifically the supply of housing.

Table 9 shows the additional housing required to meet the 35% target, using the baseline amount from the year of 2012 – comparing housing needs in 2012 in accordance with its population compared with the actual number of houses that were constructed in 2012 to meet demand.

The figures for the total housing required to meet the 2020 target are based on the assumption that the average number of people per household remains constant over time. The figures shown are strictly estimates, as explained in the demographics chapter.

The difference between units available and units constructed is large, an emphasis this report makes in order to highlight that government intervention is required to successfully meet the 35% urbanization target. Housing construction interventions should incorporate the green guidelines mentioned in this National Roadmap.

**TABLE 9:
HOUSING DEMAND FOR 2012 AND TO MEET 35% URBANIZATION TARGET BY 2020**

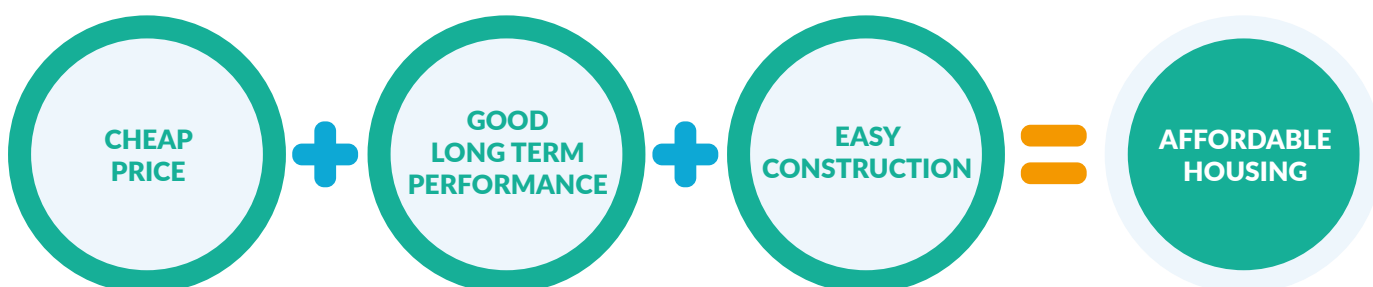
DEMOGRAPHICS	HUYE	MUHANGA	NYAGATARE	RUBAVU	MUSANZE	RUSIZI
Population of the urban area (2012)	52,768 (16%)	50,608 (16%)	47,480 (10%)	149,209 (37%)	102,082 (28%)	63,258 (16%)
Urban population by 2020 (target)	103,654	111,901	181,600	421,124	236,638	137,315
Mean size of urban private households (2012)	3.9 persons	4.1 persons	3.9 persons	4.3 persons	4.4 persons	4.6 persons
Housing needed for 2012 population	13,530	12,343	12,174	34,700	23,200	13,752
Housing needed to meet 2020 target	26,578	27,293	46,564	97,936	53,781	29,851
Difference (units to be constructed)	+ 13,048	+ 14,950	+34,390	+ 63,236	+ 30,581	+ 16,099

5.1.4 Green guidelines for building design and construction materials

Urbanization into the secondary cities of Rwanda means a displacement of low-income citizens from rural to urban areas. Therefore human settlements, especially housing, should be affordable, sustainable and in turn the construction must be feasible.

As per the **Local Construction Material for Energy Efficient and Affordable Housing in Rwanda Consultation Workshop** by the **Korea Institute of Construction Technology** (2013), there is a need to supply building materials that ensure affordability, durability, quality and are feasible to construct without difficulty.

**FIGURE 12:
KEY INGREDIENTS FOR AFFORDABLE HOUSING**

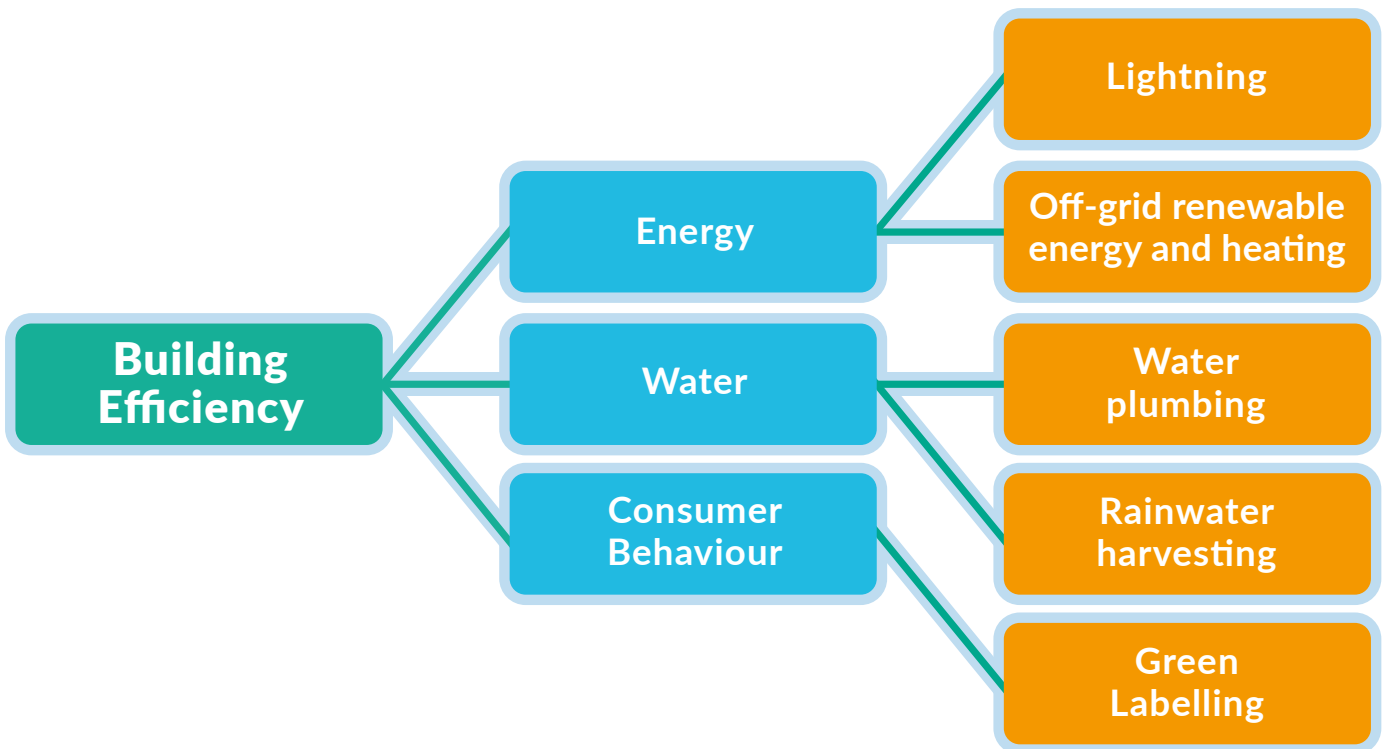


As outlined in the NCCLCD, national priorities are aligned to the following points: the provision of technically appropriate solutions that have minimal upfront costs, and have little or no operational costs. The aim of these priorities is to ensure the affordability of buildings.

In addition to and in further support of affordable building development, building efficiency also needs to be carefully considered. Building efficiency includes many aspects, as illustrated in the figure below.

Green guidelines for energy efficiency within lighting and off-grid energy production are elaborated in the Energy chapter of this National Roadmap, and green guidelines for efficient water plumbing and rainwater harvesting are elaborated in the Water chapter. Issues arising from inefficient consumer behavior in terms of lighting and water usage (consuming electricity from pumping) are covered in this chapter.

**FIGURE 13:
BUILDING EFFICIENCY**



The following guidelines for building and construction should be integrated in the planning and the development process of secondary cities.

**Guideline 1:
Promote the design of green buildings**

The **Rwanda Building Code** (May, 2015) classifies eleven types of occupancy buildings (assembly, commercial, educational, industrial, institutional, mercantile, residential, storage, memorial, mixed use and miscellaneous), where it mandates that all new buildings are to satisfy Green Construction Regulations¹⁵ in order to be granted a permit. The regulations are integrated within the building code and are to be supported by the “Green Building Practice Guide”, which is currently being developed to provide for the following: clear explanations of the regulations, their corresponding benefits and some guidance towards compliance¹⁶.

15 As per advised in the “Policy and Legal Framework for Energy Efficient Housing in Rwanda” by the Rwanda Housing Authority (RHA) in 2014

In following certain mandates in the building code there is a definitive gap as to what the best green designs are for green construction: *“Demand for sustainable design is increasing rapidly but even in the development community there are still questions over exactly what kind of green design techniques are most effective and in demand. It is important for government to provide quality service to the development and design community by training planners, building inspectors, and other local officials, as these are the main points of contact between the jurisdiction and private building interests¹⁷”*.

Overall, Rwanda’s building code emphasizes green building services, which include: energy efficiency, ventilation, lighting, air conditioning, heating, water, electricity, mechanical structures, drainage, sanitation, solid waste management.

Currently, the Rwanda **UN-Habitat** Program “Energy Efficiency in East Africa” has been working in close collaboration with the **EU Lenga** program, the **Rapid Planning** program¹⁸ and MININFRA. These organizations have contributed to the newly established building code, and are undertaking the promotion of green building designs in the **CoK**, where they have conducted trainings for local students, professionals and architects in alignment with trainings for **MININFRA** and **CoK**. They are planning to do the same in the secondary cities starting in September 2015, where they will also bring international experts to conduct the trainings for technicians.

As indicated in the **Green STAR South Africa for Use in Rwanda**¹⁹ there is potential for Rwanda to partner with a Green Building Council and thus with the Council’s expertise and technical support, Rwanda could, furthermore, establish a Green Certification System.

17 Rwanda Building Code 2015, page 678 – part 6.15.3.1.7.

18 Where the EU Lenga (BUILD) program is working in Uganda, Kenya and Rwanda, and the Rapid Planning program is working in Vietnam, Germany and Rwanda

19 WSP. Green Star South Africa for use in Rwanda. Johannesburg, 2014



Guideline 2: Build with local and sustainable construction materials

As previously explained, the selection of the type of building material depends on the climatic zones and what is available in terms of supply. Green materials would accommodate to green building requirements (enabling and facilitating natural ventilation and temperature control), be processed using green methods and be readily in supply locally to spur local economic growth.

The **Building Code** takes into account suggestions made by the **Building Materials and Housing Affordability Workshop**²⁰ in 2013 and provides ten key parameters to promote local and green building materials:

1. Local aspects of the specified material;
2. General appearance;
3. Dimension and dimensional stability;
4. Structural stability including strength properties;
5. Fire safety and Durability;
6. Acoustical, optical, thermal, mechanical properties;
7. Biological and ecological effect;
8. Environmental aspects and working characteristics;
9. Ease of handling;
10. Consistency and workability.

These parameters also take into account more simplistic methods to be able to generate affordable building materials for the building industry. There is scope for reusing and recycling materials from old buildings needing rehabilitation if they possess the right characteristics.

Overall, materials used for buildings in Rwanda are timber, clay, sand, soil and concrete. More specifically, some of these materials are processed and turned into bricks, which are the dominant form of materials used for buildings. Therefore, if there is high demand for buildings then there will also be high demands for bricks.

20 GGGI, RHA and MININFRA workshop held in March 2013 Ninzi Hotel, Kigali Rwanda

A constraint for the production of these bricks is the low capacity of local material suppliers, and therefore there is a high dependency of imported materials including low quality cement for concrete. This constraint is also rooted in the national problem of being a landlocked country that is subject to high transportation costs and high transport emissions.

Furthermore, Rwanda has a rich abundance of **volcanic rocks** in the North West region, from the Nyaragongo Volcano, which has great green potentials for building materials. According to RHA, the green technology needed for rock processing exists but is expensive to import. This potential has yet to be exploited and could bring great levels of prosperity.

Currently the **Institute of Energy and Environmental Research (IFEU)**, from the **Rapid Planning** program, is working with MININFRA on a 'Green Building Material Calculator'. It will be an Excel-based tool to determine the sustainability of buildings along with local construction material inputs. This will serve to develop a greater understanding of local green materials that can be used for construction, enabling regulators to grant permits with a greater green consideration.

Overall, the construction industry's capacity in Rwanda is low and material costs are high. Dealing with these two issues could result in huge carbon saving, and spur local employment and growth. In addition, to achieve more sustainable solutions in the building market, efforts should focus on the security of the locally grown materials supply.

**TABLE 10:
LOCAL MATERIALS FOR BUILDING**

LOCAL MATERIALS FOR BUILDING	USAGE DESCRIPTION
Timber	Rwanda has a problem of deforestation. Green sustainable methods example in Rwanda: Sorwathe Tea Glue laminated eucalyptus
Clay, Sand and Soil	Currently used for bricks and tiles. There is often illegal production of low cost bricks from wetland sourced clay, which damages the ecosystem. The bricks are of low quality (bad composition, low strength and low durability), and thus there is need for additional materials such as cement to compensate. Rwanda also produces soil stabilized compressed earth clods as an alternative to bricks. The local company called 'Light Earth Designs' is the first company in the world to have built thin shell soil vaults using soil stabilized tiles. Potential: there are extensive amounts of clay deposited across Rwanda, where the top ten major confirmed sites are in three out of the six secondary cities: Musanze, Muhanga and Huye.
Concrete	Polluting process of turning concrete to cement, where 8% of global man made CO ₂ production comes from cement production. Rwanda's cement industry is growing, and the two top cement producers are CIMERWA and Kigali Cement Company/Athi River Mining. Potential: to adopt and promote more environmentally friendly concrete production through Ground Granular Blast Furnace Slag (GGBFS), and methods for usage such as the Bubble deck system and Precast Concrete Frame
Other	Strawtec Rwanda – 100% recyclable material (straw) and biodegradable with CO ₂ footprint and the manufacturing process uses one tenth of the energy needed to manufacture standard drywall.



Guideline 3: Elaborate and implement a local green building certification

Building efficiency determines the consumption of resources in the building, where the water, electricity and land use affects the demand of this good along with its consequences to the environment. An efficient minimum use of water and electricity would reduce stress to supply these goods and thereby reduce the environmental expropriation that is associated with this. In addition an efficient use of land such as having a good drainage system for sludge to using collected rain water for gardening would help to efficiently preserve the environment around the building along with reducing pressures of demand of other environmental intensive goods.

As urbanization increases in the secondary cities, there is a need to promote building efficiency measures and thus influence the consumers' mind-frame. This should be promoted and mainstreamed into two perspectives: the side of constructing buildings (which we cover in building designs), and the end-users for consumption behavior.

Changing consumer behavior can have different approaches: (i) awareness campaigns on the benefits associated to saving resources and costs; (ii) promotions and government fiscal incentives put in place for certain products; (iii) a strong and efficient regulatory system that follow widely recognized laws to build up trust and credibility to consumers and suppliers; (iv) influencing the education system and work trainings; (v) holistic approach to building efficiency, where the consumers will extend this change of behavior and apply to other means of efficiency such as acquiring renewable source of energy at home to further save on costs or reconsidering transport methods to less polluting methods for example using the established and reliable public transport system²¹.

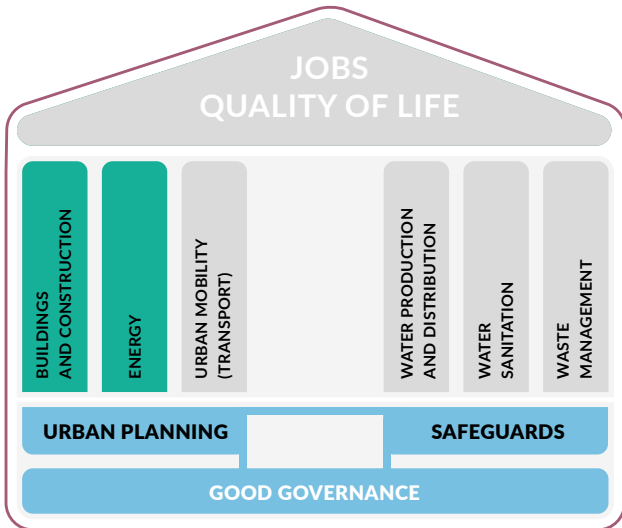
A green building certification system can be used in Rwanda as a foundation to kick start these initiatives as per outlined previously through Rwanda's potential to partner with a Green Building Council to use and learn from their expertise and technical support. This would

enable green building labeling, which in turn is a means of campaigning, from (i) above, and an outcome of (ii) and (iii) if implemented efficiently, such as the implementation of automatic light timers in public buildings. The green building labeling can be implemented through the proposed actions from guideline 1 of establishing a green certification system and extending this to publicly certify the building.

In addition, in regard to efficient use of electricity, the **Energy Utility Corporation Limited (EUCL)** is planning to establish an Energy Efficiency / Demand Side Management (EE/DSM) under MININFRA policy guidance, to develop efficiency initiatives. This should be encouraged and be implemented efficiently. This also shows potential for Rwanda to adopt similar management for efficient water use, where currently they manage water consumption through metering devices in each household. However, they have not implemented an efficient system for payment collection and are not promoting efficient water use.

21 "Affecting consumer behavior on energy demand" – EdF Energy, March 2007, Mari Martiskainen, Sussex Energy Group, SPRU – Science and Technology Policy Research





5.2 Energy production & consumption

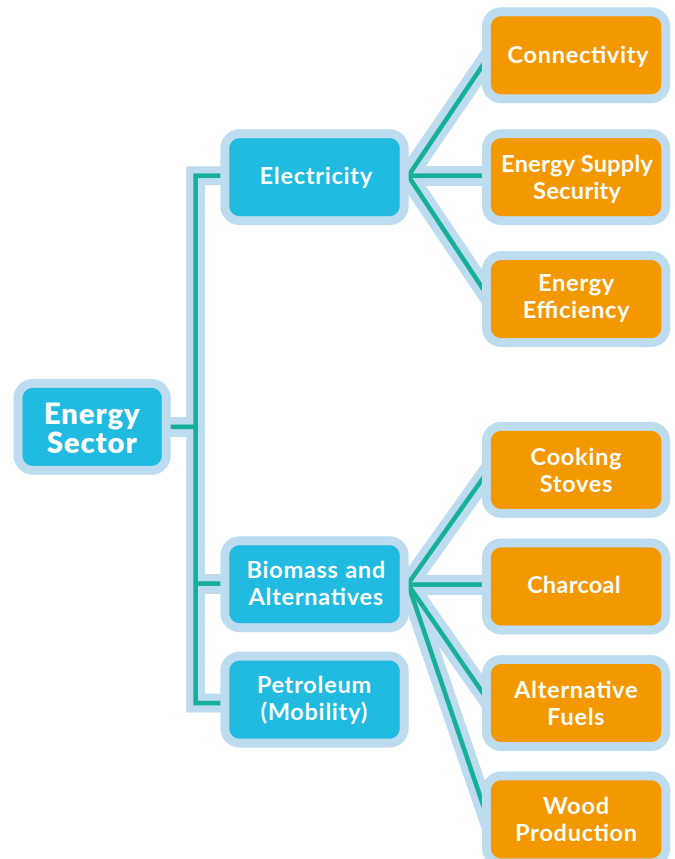
Energy is a fundamental driver of economic development, enabling productive activities and access to modern services. In Rwanda, the energy sector is comprised of three main elements: Electricity, Petroleum, and Biomass and its alternatives. Biomass is the main source of energy for cooking; access to electricity is increasing with 23% of the population connected to the grid as of March 2015, which is mainly in Kigali City; and there is roughly a 33% dependency on thermal energy²². As energy and consumption are essential for every household, energy needs to meet family needs. In this respect the **National Gender Policy** outlines to need to “sensitize the populations on the increase of men’s participation in firewood collection and other sources of domestic energy management; to ensure that women and men are involved in the development of renewable sources of energy; to ensure that rural households are trained in the use of energy saving stoves and are facilitated in accessing them; and to ensure that the number of households dependent on firewood and charcoal is reduced.”

Whilst security of energy is a national issue, so is the development of the secondary cities, and the development of secondary cities is highly dependable on the use of energy. Therefore, increasing the acquisition of affordable energy and security of energy supply in secondary cities should be prioritized. The secondary cities’ current low levels of urbanized areas leave them in an opportunistic position to adopt energy efficient measures and be connected to more green electricity when developing.

More specifically, the secondary cities would need to address and thus distinguish green guidance for the following:

- New electricity connections to new houses or buildings
- Security of energy supply
- Increases in energy capacity
- Reduction of energy costs

FIGURE 14:
AREAS IN THE ENERGY SECTOR AFFECTING SECONDARY CITIES’ DEVELOPMENT



As urbanization increases, cities face higher demands of energy. With current constraints of electricity supply, electricity capacity, and protection of biomass, there is a need to meet this higher demand with measures that mitigate carbon emissions and pursue sustainable environmental friendly methods. Emission abatement can be done successful by moving away from dirty fossil fuels to cleaner forms of energy, or by adopting more efficient approaches when consuming energy, which also includes energy consumption reduction measures.

5.2.1 Green growth and energy

Energy is fundamental for growth and by extension for green growth as well. It serves as the engine for economic development. Most commonly, developing countries are trapped into polluting and GHG emitting energy sources. Rwanda has the advantage of having an already established path to renewable energy sources, where 65% of on-grid energy comes from renewable sources (hydro and solar).

However, the low levels of connectivity of electricity along with the low energy capacity means that the majority of the population will still continue to depend on fossil fuels through independent generators, kerosene lamps, and other ways.

Energy plants take years to develop, and along with changing consumption behavior, it will take a long time for change to occur. Efforts should be applied to further renewable sources of energy, both on and off-grid, and to the protection and management of the environment for long-term benefits and to decrease dependency of the fossil fuel consumption.

With respect to the energy value chain, energy contributes to green growth if (a) the energy supply is from non-polluting sources, is secured in the levels of availability and upholds the protection of the environment, (b) energy enables green innovations that contribute to lifting economic prosperity and sustainability of development in the country, and if (c) energy is consumed efficiently. In turn, the green growth that arises from these three areas creates opportunities for new green industries, jobs and technologies during the economic transition to a green economy.

Energy production

Energy production issues in Rwanda consist of dealing with the time consuming long development plans of new resources (peat, methane, geothermal), security of energy supply, balancing supply with demand, cost of providing energy, and efficiency of the energy supplied. At the same time, whether energy sources are renewable or non-renewable needs to also be considered.

The National Strategy for Climate Change and Low Carbon Development aims to achieve energy security and a low carbon energy supply that supports the development of green industry and services. In support of EDPRS 2, in which Rwanda targets a low carbon development pathway, there is a need to reduce dependency on oil. This would reduce the country's vulnerability to oil price spikes; increase government revenue for further adoption of green measures; and thus through the multiplier effect spurs job creation opportunities, promotion of economic development and reduction in the country's GHG emissions. This is to be achieved by exploiting clean energy resources, and endorsing a low carbon national grid which will enable households and industry to consume in a low carbon manner.

The GoR is additionally currently approving the **Sustainable Energy for All Action Agenda (SE4ALL AA)** for Rwanda. The actions set extend that of the **Energy Sector Strategic Plan (2015)** and set the following targets for the period 2015-2030:

- Renewable energy – at least 26% of energy supply, and at least 44% of electricity generation
- Electricity access - 100% in both urban and rural areas through a mix of on-grid and off-grid solutions.
- Quality of electricity access - progress to higher quality and quantity of electricity over time, with >50% of the population having tier 3-5 access by 2030.
- Biomass – sustainability of supply by ensuring demand equals supply

Energy production is a key necessity for the growth of the secondary cities, more specifically the greater the proportion of energy that is from renewable sources the greater the proportion of growth that could be defined

as green. Issues of electricity generation capacity, along with dependency on polluting sources of energy, need to be addressed whilst facilitating extraction of other renewable potentials. These issues stem from main-grid generation, which is therefore a national priority.

Electricity generation capacity is currently low at 156MW (March 2015), dominated by hydropower and oil-fuelled power plants, and domestic electricity prices at USD 0.35/kWh are still high. Rwanda has over 1,000MW potential, from geothermal power, methane gas, peat deposits, biogas, regional hydropower, small scale hydro and solar PV. This would provide enough power to meet energy demand (maximum 400MW by 2020) and allow Rwanda to export electricity. Droughts reduce generating capacity of hydroelectric dams, and floods increase soil erosion and siltation which can damage dams. A good example of this is the drought in 2004 in Rwanda which reduced hydropower capacity so much so that the government was forced to rent diesel power plants to meet domestic demand.

**TABLE 11:
CURRENT ENERGY GENERATION MIX IN RWANDA**

RENEWABLE ENERGY		NON-RENEWABLE ENERGY	
Hydropower	91.97 MW (59%)	Diesel / Heavy Fuel Oil	51.8 MW (33%)
Solar	8.75 MW (6%)	Methane	3.6 MW (2%)
Geothermal	0 MW (0%)	Peat	0 MW (0%)

Source: MININFRA, June 2015

Hydropower is the main source of electricity in Rwanda both now and historically. According to the SE4ALL Action Agenda, it is predicted that an additional 313MW is available, where 130MW would be sourced domestically and the rest come from regional projects. Generally hydro projects are initiated by MININFRA and implemented by REG Ltd. The major constraint for hydropower is climatic change and prolonged droughts reducing the water levels significantly in the rivers and the lakes.

This has pushed Rwanda to import more diesel and heavy fuel oil and thus become more dependent on them to compensate for energy losses. Hydropower is the most sensitive and vulnerable to further changes in climate as its efficiency levels depend on the amount of water, timing and geographical pattern of precipitation and temperature.

Solar energy faces less technical problems than hydropower, and can be installed quickly. For instance, the Agahozo solar plant, now the largest solar power plant in East Africa was installed in late 2014, producing 8.5 MW of electricity, approximately 6% of Rwanda’s total power supply.

There are two prominent constraints of solar energy flows to the main grid: firstly, the capacity levels of energy varies during the day due to the sensitivity of cloud blocking, thereby pressurizing other energy sources to provide the energy supply gaps to keep the system stable; secondly, solar energy can only generate energy during daylight hours, which is especially a problem during the peak evening hours when lighting is required, resulting in a need for solar energy storage facilities. However, these are too expensive and would make solar energy uncompetitive.

Geothermal energy is capital intensive, where various types of technology are needed for its complex process. The resource potential in Rwanda is 47 MW and 90MW at 80% and 50% confidence levels respectively²³. Measurement uncertainties are high and thus require three stages in the exploration process: an analysis of the topography; an analysis of magnetometry and gravitometry; and the drilling itself to locate the energy.

Four prospect areas have been identified in Rwanda, with the Karasimbi already having proceeded with drilling and failing to find any geothermal energy resource. The process is generally very risky and costly, where each drilling well costs approximately \$6 to \$10 million.

Wind energy is becoming increasingly common globally, it has been found that Rwanda has low wind resource potential. Further studies are to be undertaken to provide a more detailed resource assessment. Additionally, wind energy is also intermittent, and therefore faces similar complications to solar power.

Diesel and Heavy Fuel Oil (HFO) are a significant source of non-renewable energy in Rwanda. This is due to the pressures of water resources from existing hydro power plants and a pronounced peak demand in the evening. Diesel and HFO plants are relatively cheap, quick to build and less capital intensive than renewable energy plants. However, they are expensive to run as fuel costs are high. They are currently in use for base load generation i.e. 24 hours a day and therefore incredibly expensive if used in this way.

There are current actions that emphasize the phasing out of diesel and HFO so that they only cover peak demand for a few hours. However, the current pressures of high growth rates especially to develop the secondary cities put increasing pressure to continue using Diesel/HFO. The SE4ALL AA advises to take action on the hours in which this energy source is to be used: encourage using this energy source only at peak hours and perhaps to compensate for the solar energy source that can currently only be used during daylight hours. In addition, there is potential to set guidelines on more efficient Diesel and HFO use, which will also impact on usage from transport.

Peat to power poses strong environmental concern for two reasons: firstly, the large amount of CO₂ emissions when converted into energy; and secondly, the extraction of peat from the earth means there is less solid material in the soil that normally controls water flows, therefore contributing to flooding. It is important that peat extraction programs undergo extensive environmental impact assessments (EIAs) for regulation of flooding or drought conditions, which REMA already conducts. In addition, REG Ltd is following peat standards set by the EAC.

Methane can become a significant source of energy in Rwanda. Lake Kivu, situated in the west of Rwanda, has an estimated 55 billion cubic metres of methane gas and accumulates approximately 150 to 250 million cubic metres of methane a year. The energy potential for methane from the lake is estimated at 700MW over 50 years, which means 350MW for Rwanda due to its sharing agreement with neighbouring DRC.

The technology could pose security challenges and its supply chain has not yet been established and plant parts are expensive to import. Lake Kivu is also only one of three such methane lakes in the world.

There is the potential for the methane to be considered a renewable energy source: “if methane is extracted from the lake at the same rate at which it is generated from decomposing organic matter, then supply of gas could last indefinitely and would be renewed annually²⁴”

Green energy production

As the secondary cities grow, energy demand will also grow. If energy is mostly sourced from renewables, then this in itself contributes to green growth. MINIRENA has already done a technology needs assessment to identify green technology that could be applied to the existing and potential sources of energy in Rwanda²⁵ (for both renewables and non-renewables.) This assessment outlined technologies that can be adapted to Rwanda’s current energy sources to address the environmental issue of carbon emissions and limitations on current energy sources’ capacities. These technologies are for both renewables and non-renewables, and can therefore contribute to the transition to a greater share of renewable energy supplying the main grid.

Table 12 below shows peat as the worst polluter and nuclear (used only for baseline purposes) is the best as the least contributor to GHG emissions. The table also shows the green technologies that can be adapted to Rwanda’s energy sources, which will make the process and outcome greener in terms of less GHG emissions.

It should be noted that Carbon Capture and Storage technologies are new for Rwanda but have the advantages of sustainably reducing GHG emissions. In particular, Lake Kivu methane CCGT, peat based IGCC gasification, and the peat based ECBM are significant and should be mainstreamed.

24 SE4ALL Draft Rwanda Action Agenda

25 MINIRENA. Technology Needs Assessment and Technology Action Plans for Climate Change Mitigation and Adaptation. MINIRENA. Kigali, 2012

**TABLE 12:
CONTRIBUTION OF VARIOUS ENERGY SOURCES TO GHG MITIGATION IN RWANDA**

ENERGY SOURCE	GREEN TECHNOLOGY	AVERAGE CO ₂ EMISSION (g / kWh)	TOTAL AVERAGE CO ₂ EMISSION (ton / year)	COMPARATIVE EMISSION REDUCTION
Peat	Peat fired; steam	1,075	301,000	N/A
Oil	Internal Combustion; GT	750	210,000	0%
Kivu Methane Gas	Combined Cycle Gas Turbine	630	176,400	16%
Geothermal	Steam Turbine	197	55,100	74%
Solar	Photovoltaics	155	43,400	79%
Biomass	Bio-stream	58	16,200	92%
Solar	Concentrating Solar Power (CSP)	43	12,000	94%
Wind	Wind Turbine	43	12,000	94%
Water	Wind Turbine Hydropower	43	12,000	94%
Peat Enhanced Coal Based Methane (ECBM)	Gas Turbine Directly Fired for Thermal Use	630	176,400	16%
Biodiesel	Internal Combustion Engine	43	12,000	94%
Peat Integrated Gasification Combined Cycle (IGCC)	Gas Turbine; Steam Turbine; Heat Recovery	630	1,764,000	16%
Nuclear	Steam Turbine	11	N/A	N/A

Source: *Technology Needs Assessment & Technology Action Plans for Climate Change Mitigation and Adaptation, MINIRENA 2012*

Energy production is a key necessity for the growth of the secondary cities, more specifically the greater the proportion of energy that is from renewable sources the greater the proportion of growth that could be defined as green. Issues of electricity generation capacity, along with dependency on polluting sources of energy, need to be addressed whilst facilitating the extraction of other renewable potentials. These issues stem from main-grid generation, which is therefore a national priority.

On the other hand, secondary cities have the potential to adopt off-grid energy production methods as well. This will help alleviate current energy pressures from the grid whilst making themselves less affected by on-grid generation issues.

Energy consumption

The main grid in Rwanda covers all of the secondary cities. The rollout of the grid is planned and implemented through the Electricity Access Rollout Programme (EARP) run by Rwanda Energy Group (REG Ltd), the recently corporatized energy agency of MININFRA. The program aims to meet access targets set out in EDPRS II (70% or 1.7 million households by 2018), with on-grid access currently 23% (March, 2015). This ambitious target calls for efficient government intervention, and current priorities already include new connections within secondary cities. The revised ESSP has prioritized connecting the following in the respective priority order: large and productive users, schools and hospitals; small and medium enterprises (SMEs); and households.

Energy consumption issues in Rwanda consist of ensuring that electricity supply meets demand: reaching end-users who wish to consume electricity (particularly industrial users); the current over-consumption of biomass and energy efficiency issues. These issues are going to be enhanced when secondary cities grow.

In Rwanda, households are the main users of energy (91%) along with transport (4%), industry (3%) and public services (2%). In regards to electricity consumption, households are also the dominant users (51%), and this is mainly used for lighting. The industrial sector is the second largest user of electricity (42%), which is mostly used by motors and lighting. The third user for electricity is the public sector (6%), which is mainly used for public buildings, street lighting and water pumping²⁶. Therefore overall, maintaining electricity access, promoting energy efficiency and limiting biomass consumption is crucial to achieve green growth.

In regards to the nation's economic productivity, the industrial sectors, that are energy intensive, do not produce at optimal levels and thus have low productive capacity from the insufficient allocation of electricity. According to **International Growth Centre (IGC)** and Laterite in 'Understanding Rwanda's Agribusiness and Manufacturing Sectors'²⁷, constraints in energy consumption especially in manufacturing and agribusiness include:

- Geographic coverage of electricity, where it has dictated industrial settled developments around the country
- Difficulties of implementing energy-intensive manufacturing or agribusiness activities
- Creation of difficult business environment for smaller firms that have not grown sufficiently to overcome their fixed electricity costs
- Enhanced the demand constraints by increasing the minimum required amount for viable production, as well as supply-related issues

Therefore it is clear that the national problem of energy production is affecting energy consumption and thus economic growth, and in turn green growth. Energy is a fundamental ingredient for the secondary cities' potential prosperity.

26 Energy Sector Strategic Plan, March 2015

27 International Growth Centre. Understanding Rwanda's Agribusiness and Manufacturing Sectors. London, 2013

Development of the secondary cities will spur further energy consumption, adding to the current pressures in the biomass sector, and create a wider set of energy inefficiency problems. Realistically, secondary city growth will still depend on biomass for further growth as it is the main fuel for cooking, and unlikely to change anytime soon. This negative association to the environment and thus green growth requires clear and well managed regulations before the negative effects become irreversible. In addition, mainstreaming energy efficiency measures prior to large influxes of urban dwellers can offset the potential large inefficiencies associated with energy consumption.

5.2.3 Energy needs of secondary cities

Projecting energy consumption needs for the Vision 2020 target of 35% urbanization using population projections for the secondary cities is deemed difficult due to the lack of data. Current energy consumption data is only available for the four regions in Rwanda: City of Kigali as the only urban area, and its surroundings, which are considered to be rural²⁸.

5.2.4 Greenguidelines for energy production and consumption

Providing access to energy is an essential pillar for the urbanization of the secondary cities. Without energy economic growth is difficult, and there is less of a reason to move to cities which typically provide access to services such as energy, and also services made possible by energy such as hospitals, modern schools, public services, and modern businesses. In addition, energy provides safety at night, lengthens the productive working day, and enables people to cook and live more healthily, thereby improving the quality of life. Energy access directly impacts on a city's growth potential, and is key for permitting sustainable solutions mentioned in the other thematic chapters of this NR.

28 Approach done by Sofreco and replicated by the Japan International Cooperation Agency (JICA) – February 2015 – "Briefing on load Demand Forecast"

While actions are possible at each stage of energy development (development, supply, transmission and distribution, and use) that could enhance green growth potential, the majority of these are at a national level. Therefore this NR focuses on those areas that are most under the control of districts and relate to the secondary cities.

The following green guidelines for energy should be integrated in the planning and the development process of secondary cities based on the contextual information and theoretical analysis given in this chapter.



Guideline 1:

Implement renewable energy source for the main grid

As secondary cities grow with the national energy issues constraining growth, encouraging efforts for off-grid solutions at household and industrial levels is beneficial in the short run. However, secondary cities will not be able to sustain themselves on only off-grid sources and will continue to face some dependency of acquiring energy from the main grid especially when facing increasing demands from increasing economic activities.

While Rwanda is already successfully supplying the main grid with a high proportion of renewable energy sources, there is a need to increase this proportion, but most importantly make it sustainable. This will contribute to energy security at national level. The SE4ALL Draft Action Agenda sets out actions to achieve this path. When this is approved, there is a potential to mainstream SE4ALL actions and mission to all the districts for alignment of understanding but more specifically, conduct pilot actions in the secondary cities to set a good national example.



Guideline 2:

Acquire and install energy efficient lighting along with automated lighting systems in public buildings and for street lighting

There is currently a Compact Fluorescent Lamps (CFL) program that mainstreams the usage and distribution of CFL efficient lighting. The program is estimated to have already distributed 800,000 heavily subsidized units,

with an estimated annual saving of 36GWh. The planned establishment of the Energy Efficiency/Demand Side Management (EE/DSM) Unit at REG Ltd will take over this program and, working alongside MININFRA, will conduct an investigation into further procurement and distributions of the CFLs. However, emphasis should be put on extending this investigation to Light Emitting Diode (LED) lighting as it provides stronger energy savings, performs better as they have a longer lifespan, and disposing of LEDs is greener than that of CFLs because of the mercury contamination. LEDs are also more expensive, and therefore to be economic they should replace CFLs at the end of their lifespan.

In addition, the EE/DSM Unit will need to finalize and implement the Energy Efficient (EE) code for street lighting and provide technical support on viable EE street lighting methods. The local authorities in each of the districts, and therefore each of the secondary cities, shall be responsible for the payments and maintenance of street lighting to spur incentives of efficient energy use. There is an on-going assessment study about replacing the sodium HPS street lamps with LEDs, and replacement has already begun under a program in CoK. The development of the secondary cities has the potential to adopt and mainstream these more efficient lighting systems.



Guideline 3:

Develop off-grid energy to offset pressure from on-grid energy

Reducing consumption of electricity from the main grid enables the cities to be more self-efficient, especially when acquiring off-grid renewable solutions such as Solar Water Heaters (SWH) for the purpose of heating water; and solar photovoltaics (PV) and mini-hydro for electricity generation for households and productive users respectively. Mini-hydros could serve as autonomous generators for specific industries, or supply households through mini-grids. Solar PV can be provided through stand-alone systems such as household systems or portable solutions. As urbanization increases into the secondary cities, the already troubled electricity supply will face greater demands. Therefore, already prepared self-efficient methods can reduce this pressure and in turn save on electricity costs, as the cities wait for main grid issues (quality and availability of supply, and cost) to be resolved.

Rwanda's geographical location enables the acquisition of a valuable amount of solar radiation: approximately 5 and 6 kWh / m² / day with a daily average sunlight time of 8 hours a day. GoR is already encouraging least cost and sustainable renewable energy options, making Rwanda eligible for green funding such as, already acquired from the Global Environment Facility Fund (GEF)²⁹.

The current strategies from REG Ltd for on/off-grid systems are the following³⁰:

- Encouraging private developers to invest in hydro mini grids targeting productive users
- Incentives from the recently approved Energy VAT exemption list (August 2015), targeted at renewable energies for both on/off grid solutions, among other things
- Encourage local private sector to invest in manufacturing or assembly of solar home systems and accessories.

Therefore, efforts are needed to implement these strategies in secondary cities that could potentially serve to be an example for their corresponding surrounding areas, including providing the right expertise and funding opportunities.

Off-grid energy sources are mostly prioritized for rural areas as the grid will take longer to reach those areas. However, there could also be large benefits in encouraging off-grid energy solutions in the urban areas (secondary cities) in the short-to-medium term to offset grid issues whilst the cities develop: providing them with possibly more reliable and cheaper forms of energy.

There is a need to foresee targeted geographical locations of the current players for Solar PVs along with their methods of promotion and selection processes, as there could be benefits in linking with secondary cities for further development of the implementation of solar PVs. In addition, there is a need to analyse which of the secondary cities are the most optimal to benefit from solar off-grid solutions as different areas have different solar radiation concentrations, and locate nearby mini-hydros for use.

29 GEF has granted Rwanda US \$4.5 Million for Rwanda sustainable energy development project (SED Project)

30 Rwanda Energy Group (REG Ltd) – Off-grid electrification program through solar pv systems for the period July 2015 to June 2018



Guideline 4: **Promote sustainable consumption of wood fuel for energy efficiency**

Currently, biomass consumption in Rwanda poses a great burden on the environment due to the high carbon emissions rate and consumption rate, as its demand is higher than its supply, and this gap is only increasing further with: population growth, increases in household income and growing urbanization rates.

Approximately 97% of household cooking comes from biomass, where it is composed of 86% wood (eucalyptus or agriculture residue), 11% charcoal (processed from wood), 2% crop waste and 1% other fuels³¹. As urbanization increases, energy sources from biomass will also increase due to transitions from wood to charcoal (which is made from wood), therefore adding to the already pronounced problems. In addition, this transition also means a continuation of using polluting methods of cooking, which is harmful for health and contributes to household emissions, which in large masses, contributes to the city's heat emission.

Various types of Improved Cook Stove (ICS) initiatives have been introduced to reduce the demand for biomass consumed for cooking, whilst increasing efficiency and decreasing health damage at the same time. Household penetration is currently estimated at 70%, although it is assumed this doesn't include replacement. Urban areas in particular, have faced an increase in alternative cooking approaches such as electric stoves, microwaves and Liquefied Petroleum Gas (LPG), although only in small quantities.

Given the optimistic urbanization targets, during economic development there will be an increase in the transition to the alternative cooking methods. However, consumption of biomass for cooking will increase and still dominate, with charcoal consumption increasing significantly as urbanization occurs and wood is less easy to access. Note that biogas is also used in Rwanda for cooking, however whilst the technology is already used to convert biogas to energy or productive agricultural fertilizer by institutions such as schools and prisons, it is largely a rural solution for farmers and not suitable for city use at small scales.

31 SE4ALL Action Agenda Draft 2015.

The Rwanda **SE4ALL AA** Draft targets the following for biomass by 2030:

- To close the gap (currently about 20%) between production and consumption of biomass to make it a sustainable source of energy
- To supply a growing and urbanizing population with clean secure supplies of biomass for cooking, 3 main pillars of the sector will need to be addressed:
 - 100% access to much more efficient cook stoves than currently used
 - Reduction in losses from charcoal by improving charcoal production and partially replacing charcoal with biomass pellets
 - Increasing production by improving forestry management
- To ensure that the efficient cook stove solutions noted above address health issues by significantly reducing indoor air pollution

For biomass to be a secure and sustainable source of energy as defined by the SE4ALL AA, there must be a balance between the production and consumption of biomass³². In addition, the 2009 biomass energy strategy (BEST) states that biomass has the potential to be a sustainable fuel source as long as the gap between production and consumption can be diminished through improvements in productivity and consumption efficiency.

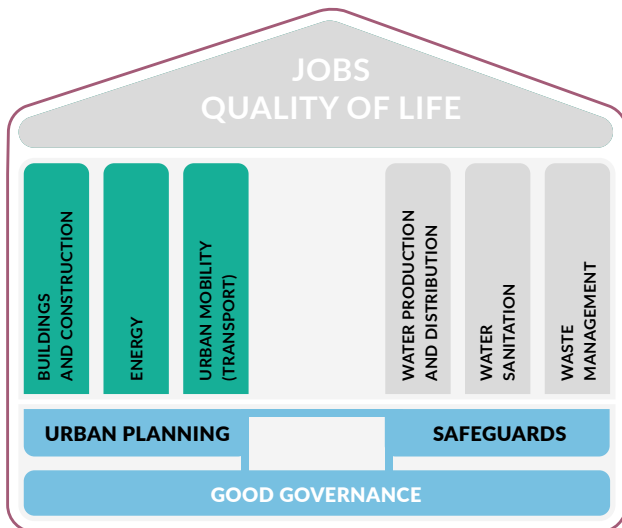
In this matter, direct action can be undertaken in order to improve efficiency of **cookstoves, charcoal, wood production** and **alternative fuels**.

Energy is a pillar of green urbanization and acts as the engine for green growth. Current energy problems affect the developments of city life. For example, electricity helps visualize surroundings at night thus extending the ability to carry out further activities in the course of the day; it enables the usage of technologies, which accounts to an exponential list of machines and devices such as charging phones and computers for increased communications and interactions locally and internationally, which in turn influences and extend the knowledge capacity. In regards to the National Roadmap,

the other pillars have some levels of dependency to energy, such as water pumping, green machineries for road construction, green machineries for material processing and energy to transport waste and sludge to their respective destinations. Energy therefore acts as the engine for green growth, but with a strong consideration that the engine also has to be green.

32 “Production of woody biomass is the annual amount of wood grown each year, whilst consumption is the amount cut each year. If consumption exceeds production, then the stock of trees will be reduced over time. Nearly all the woody biomass used in Rwanda comes either from dedicated plantations or agro-forestry sources.” – page 5 of SE4ALL Action Agenda Draft.





Urban mobility is closely intertwined with urban development. However, transport conditions tend to worsen as economic development increases due to the increased level of polluting vehicles on the road to carry out the additional economic activities, which in turn leads to higher levels of congestion. While employment, health conditions, sanitation, access to water, and education tend to improve through economic development, transport problems tend to worsen. There is therefore a need for efficient management of the planning of roads along with establishing a reliable and efficient transport system that can reduce the use of vehicles on the roads. In addition, changing the inhabitants' mindset of urban mobility is crucial, which can only be effective from setting a good enabling platform for the inhabitants.

The development of secondary cities offers a unique opportunity to implement a sustainable urban mobility framework and diminish the carbon footprint of urbanization. Giving priority to pedestrian/bike—friendly streets and implementing an efficient public transport system would ensure sustainable and well-managed mobility for inhabitants.

5.3 Urban mobility

A city's vitality and development relies on the ease of mobility from the established road networks and means of transportation.

Road networks facilitate economic exchange and spur urban development. A sound transport system from the established road networks, in turn, facilitates the mobility of the inhabitants it serves, whether it is from rural and peri-urban to urban area or within the urban area itself.

Roads generally occupy a significant proportion of the urbanized area and the way roads are planned, especially in terms of their width, has a direct impact on the perceived density of a city and the quality of life. Moreover, as the road network provides a space for the movement of persons, vehicles and goods, the way it is used by the different transport modes has a consequence on the sustainability of a city – notably with regard to its carbon emission. Women and girls often spend more time and effort on transport (due to household chores such as fetching water and wood) and face greater safety and security risks when travelling. The **National Gender Policy** stipulates “ensuring that feeder roads status is improved to facilitate the users (who are mostly women) in accessing basic services; adopting a state-supported programme of cheap and gender sensitive transport; and ensuring that multipurpose public amenities with toilets for women and men are constructed at strategic points along main highways.”

5.3.1 Green growth and urban mobility

Transport is directly linked to a green growth in three thematic areas. Firstly, transport has a major environmental impact in terms of GHG emissions, local air quality, and noise. Secondly, using resources efficiently and building the right infrastructure for the roads enables better management of city congestion and in turn positively influences the city's vitality. Thirdly, public, private and donor investments for green growth are targeted directly at the transport sector (such as public transport and alternative eco-friendly vehicles), to reduce emissions from vehicles to mitigate impacts to climate change and contribute to the sustainability use of resources within the transport sector³³.

33 Clarke, L., and K. Calvin. Sectorial approaches in international and national policy. Presentation for the 2nd International Expert Meeting on Bottom-up Based Analysis on Mitigation Potential. 2008.

The transport sector is a major emitter of GHGs, and was responsible for 23% of world energy-related emissions in 2009, with about three quarters coming from road vehicles. By the year 2035, transport is expected to become the single largest GHG emitter, accounting for 46% of emissions 4. Currently 95% of global transport energy comes from petroleum, and energy is consumed in the manufacturing and use of vehicles, and is embodied in transport infrastructure including roads, bridges and railways.

The footprint of urban transport on the environment can be reduced by improving the infrastructure that enables walking and cycling, and by improving public transport systems such as efficiency of bus services. The tools developed to support transport sector decision-making in others countries, provide a good basis for the economic assessment of green transport policies country-wide.

In the context of rapidly urbanizing nations like Rwanda, three trends are generally observed:

- The level of car ownership relies heavily on a country’s economic development.
- Countries with low GDP per capita are seen to have a similarly lower level of car ownership, as only few people are able to afford a car.

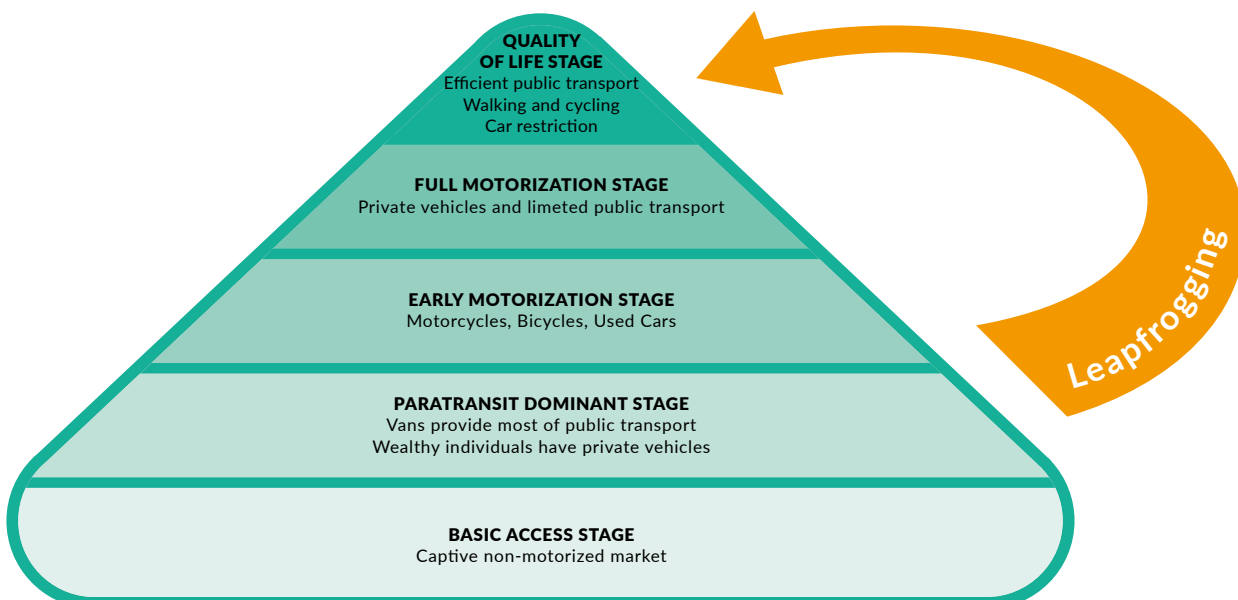
- Countries with high population density tend to continuously improve the public transport system and infrastructure, leading to a lower need for private cars or other types of vehicles.

However, despite these three trends, when the public transport system is small infrastructure improvements tend to happen slowly and safety standards are not met. Therefore, there is a greater incentive for people to opt for their own vehicles rather than rely on public transportation.

From a social perspective, favouring car-only roads in urban development can increase inequality and could intensify poverty and inequality. If an effective public transport system is not available, the vast majority of the population cannot commute or have to spend a significant part of their revenue on mobility. In this context, access to jobs and economic opportunities is more difficult.

The **Munasinghe’s theory** provides insights on how developing countries can heave appropriately in order to achieve growth without following the “develop first, clean up later” path of other nations. Bypassing intermediate development steps and progressing directly to more advanced and green technological option is both possible and feasible for the transport sector in Rwanda. Regarding urban mobility, this leapfrogging process implies the implementation of more sustainable transport options

FIGURE 15: HIERARCHY AND EVOLUTION OF URBAN MOBILITY AND LEAPFROG OPPORTUNITY



rather than favouring urban policies that promote car use. Figure 15 below illustrates the opportunity to apply Munasinghe's theory for promoting sustainable urban mobility in secondary cities.

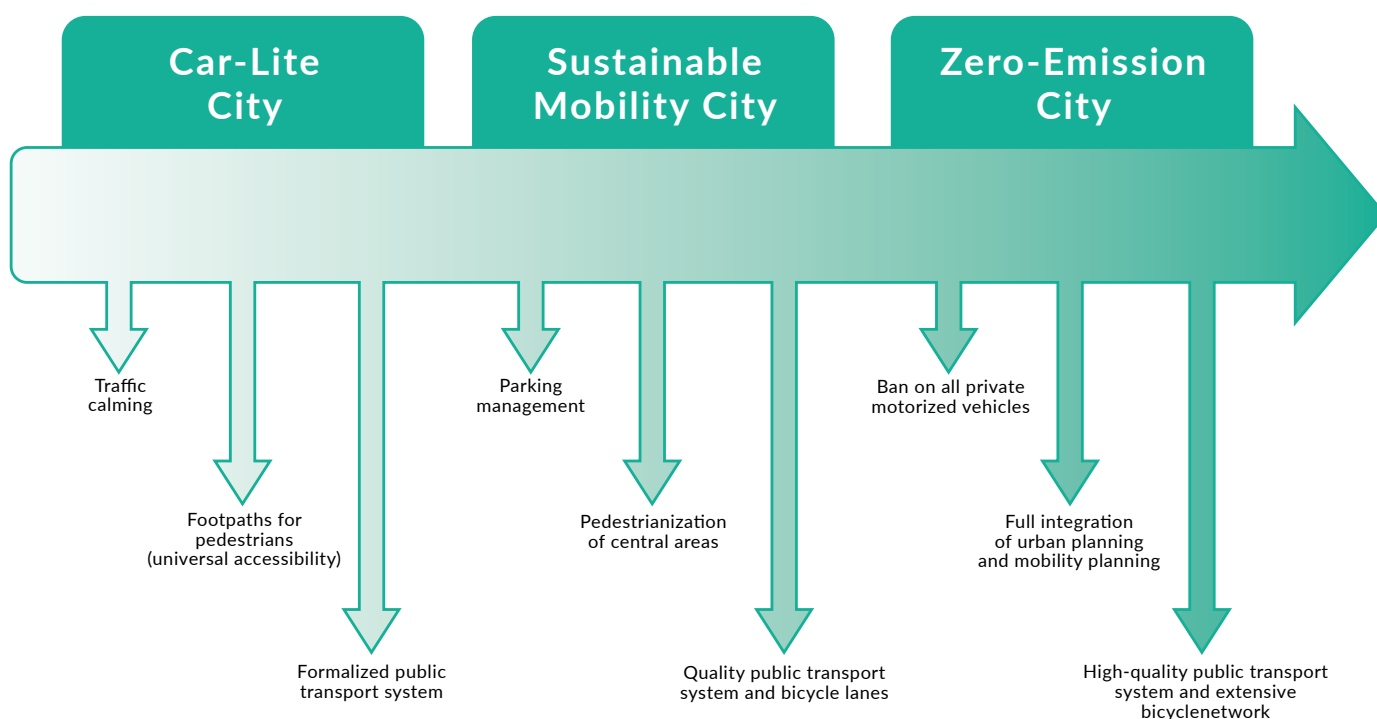
Developing the transport sector to accomplish green city developments requires financial and technical investments in the various areas of the value chain. Moreover, the actions undertaken for improving the mobility in a city should be part of a comprehensive and scalable strategy.

Quick win actions such as implementing traffic calming measures in residential areas or providing a network of footpaths for pedestrians is a first step toward increasing the sustainability level of urban transport. Implementing a sustainable urban mobility framework should be phased progressively.

Targeting the development of a 'car-lite' city (discouraging vehicle use without an absolute ban), is an encouraging objective. As efficient measures are implemented (such as public transport and parking management), the overall sustainability of a city increases.

Developing a zero-emission city from scratch is possible (Masdar City in United Arab Emirates is a good example) but it requires a large amount of capital investment. Figure 16 below illustrates a potential range of options for building cities that are less dependent on private vehicles.

FIGURE 16:
RANGE OF SOLUTIONS FOR SUSTAINABLE MOBILITY IN A GREEN CITY



Source: Wright, L. 2005. *Car-Free Development*. Eschborn: GIZ.

Considering the relatively low level of development of secondary cities, the implementation of a sustainable urban mobility framework at the beginning of the urbanization process is an essential component to achieve a green growth path.

Planning in advance will mean that the mobility of inhabitants and goods is in-line with the planned urban area. This will help avoid making the mistakes experienced in other developing cities. Additionally, encouraging a reduction in the dependency on oil through smart urban mobility planning is a sound strategy for Rwanda. The petroleum sector is not currently well developed, where Rwanda is dependent in importing the petroleum used in the transport sector.

Rwanda is a country with a low motorization level. Only 1.2% of households own a car and 1.2% own a motorcycle. The assessment of the sector shows that amounts of private vehicles are expected to increase proportionally to the projected population growth rates of 2.3%.

With the exception of Kigali, urban public transport systems are non-existent within city areas and are established between urban areas around Rwanda. Most urban commuting is done by non-motorized transport (walking and cycling) or by motorcycle.

Despite the currently low vehicle ownership rate, private car ownership is increasing rapidly, where – between 2009 and 2010, a total of 6,878 vehicles were imported in the country and there are currently approximately 120,000 registered vehicles in Rwanda (2015).

The Strategic Transport Master Plan for Rwanda prepared by Rwanda Transport Development Agency (RTDA) provides guidance for the development of integrated medium and long-term land transport programs for the next 10 years in conformity with Vision 2020 and the objectives of EDPRS 2.

In terms of urban mobility, the following key programs are identified in the Strategic Transport Master Plan:

- 140 km of all main roads in major urban centres have basic facilities for public transport, non-motorized transport and pedestrians
- Feasibility study and Detailed design on the construction of 3 town bypass roads in Huye, Muhanga and Musanze

Also, the following sustainable and eco-friendly initiatives are planned:

- Setting up additional four regional vehicle fitness and environmental rating inspection centres
- Public transport incentive and private car disincentive measures, such parking control and dedicated bus lanes
- Development of 100 km of High Quality footpath on both sides of roads with shade tree at 10 m interval including wheel chair access facilities for the disabled.

RTDA was established by Law No. 02/2010 of on the 20th of January 2010 as an autonomous Government agency under MININFRA with the mandate: to implement government transport policies and strategies; to advise the Ministry on all transport sector matters; and to conduct project management. The agency is a key actor for the development of a green urban mobility framework in secondary cities.

The regulation of the transport sector is under the responsibility of **RURA**. The mandate of the agency is to regulate public utilities, including transportation of persons by all modes.

At the local level, based on the decentralized administration framework, the district infrastructure departments are responsible for the development and maintenance of local unpaved and communal roads, thus making them responsible for the execution of the road maintenance procedures as well as assisting the Ministry in reviewing the Road Maintenance System.

5.3.3 Prospective needs of secondary cities in terms of urban mobility

Secondary cities, on average, have underdeveloped road networks for secondary roads, with the exception of the established primary roads all over Rwanda. Public transport systems within cities are almost non-existent, and urban commuting is dominated by bicycles and motorbikes. In informal settlements the roads tend to be worse off and access is often limited due to the low conditions of paths.

In secondary city districts, car ownership is lower than the national average and significantly lower than in Kigali. The level of car ownership has a positive correlation to the level of wealth, which explains the current lower levels of vehicle ownership and high levels of bicycle ownership.

**TABLE 13:
RATE OF OWNERSHIP OF PRIVATE TRANSPORT VEHICLES PER DISTRICT**

DISTRICT	KIGALI CITY	HUYE	MUHANGA	NYAGATARE	RUBAVU	MUSANZE	RUSIZI
Car Ownership	7.0%	1.1%	0.8%	0.7%	1.1%	0.8%	0.5%
Motorcycle ownership	2.6%	1.1%	1.3%	2.5%	1.3%	1.0%	0.8%
Bicycle Ownership	8.2%	14.9%	8.2%	39.4%	5.8%	8.1%	4.8%

Considering the low motorization rates of secondary city districts, these cities are in a unique position to shape their urban form before the culture of motorization becomes fully established. Implementing smart urban planning principles and providing basic public transport will help to slow the motorization process, thus contributing to minimizing carbon-emissions from the secondary cities.

5.3.4 Green guidelines for urban mobility in secondary cities

One of the leading international approaches to green urban mobility can be summarized by the following formula³⁴: ‘**avoid – shift – improve**’.

Firstly, this means improving spatial configuration and providing more compact and multifunctional urban areas that would help to reduce or avoid the need to undertake lengthy commuter trips. Secondly, the notion of a ‘shift’ supposes that a gradual shift can be undertaken to modes of transport that are cleaner, eventually utilizing no fossil energy sources. For Rwanda, a ‘shift’ isn’t applicable as the rate of private vehicle ownership is so low; in fact measures to slow the inevitable increase in car ownership are more realistic. Lastly, improving urban mobility could be realized by enhancing fuel technology. Fuel and propulsion system strategies may include technology options such as electric and hybrid vehicles, natural gas vehicles, and biofuel vehicles. In Rwanda, such policies would be developed and adopted at the national level.

Urban mobility is a central pillar for the rapid urbanization of the secondary cities in Rwanda. Providing a green framework along with tangible actions for the planning and implementation of the transport sector is strategic for urban sustainability.

34 MEHNDIRATTA, Shomik. Urban Transport and Climate Change. In Low-Carbon Cities Development in China. World Bank. Washington, 2012.

Guideline 1: **Plan urban development in order to reduce the need for commuting**

The synergies between transport and land development are evident thereby combining mobility and spatial development is a crucial component of urban green growth. A denser city where poles of activities are in close proximity to each other will provide an urban environment where the need for long-distance commuting is reduced.

The transport sector planning has to be integrated to the urban planning in order to link mobility trends of inhabitants to the city’s framework. For secondary cities, this means incorporating a sustainable urban mobility strategy to the MPLMUP and LLDP. A secondary city’s MPLMUP should plan for higher urban densities and increased mixed-uses in all new neighbourhoods. Therefore, providing an urban environment where people can go to work, shop, and socialize near their home will minimize the need for transport, and consequently reduce the need to get or use a private vehicle (car or motorcycles)³⁵.

On average, an internationally cited standard for acceptable walking distances in an urban environment is about 400 meters (Atash F. 1994). Local culture has an influence, but in general, most people will accept to walk 400 meters without using a motorized mode of transport.

35 United States Department of Transportation’s National Highway Traffic Safety Administration and the Bureau of Transportation Statistics. National Survey of Pedestrian and Bicyclist Attitudes and Behaviors. Washington DC, 2012.

As such, new neighbourhoods in secondary cities should be planned with this standard in mind in order to facilitate non-motorized access to jobs, commerce and services. Similar attention should be given for public transport: as indicated before, new neighbourhoods should be planned so that an existing or a planned bus route is always less than 400 meters, or 5 minutes walks away.

In addition to a comprehensive strategy for new pedestrian-friendly and transit-oriented neighbourhoods, the MPLMUP of a secondary city has to include a strategy for sustainable urban mobility. Such a strategy should foster balanced development and a better integration of the different methods of urban mobility. A sustainable urban mobility strategy aims to create an integrated transport system by addressing the following objectives³⁶:

- Ensure all citizens are offered transport options that enable access to job opportunities, key destinations and services
- Improve safety and security
- Reduce energy consumption and GHG emissions
- Improve the efficiency and cost-effectiveness of the transportation of persons and goods
- Contribute to enhancing the attractiveness and quality of the urban environment.

The preparation of a sustainable urban mobility strategy requires achieving the objective of planning the city for the inhabitants and not vehicles: Instead of focusing on the fluidity of traffic the focus has to be given to accessibility and quality of life of inhabitants.

Guideline 2: **Plan a walkable city**

Roads should be planned for multimodal use and not only for cars. Currently, most people in secondary cities commute to work, school or services by means of walking. This is due to the low motorization level, and the close-proximity of activities (housing, services, jobs, equipment) in existing neighbourhoods. This explains the low environmental impact of current mobility trends in

Rwanda. However, the rapid urbanization and increases in the level of wealth is showing an increasing modal transfer to cars. In order to mitigate and decelerate this modal transfer, it is imperative to provide an attractive and well-planned environment for pedestrians and bicycles. In secondary cities, reducing the modal transfer to motorized modes and promoting walking and bicycles would result in: increased capacity, and reduced congestion, in the overall transport network; reduced environmental impacts; improved public health and reduced healthcare cost; improved community wellbeing and social cohesion; and sustained business for shop-owners

A walkable city is a city that prioritizes pedestrians and is safe for children. If a city is safe for children, it will be safe for other groups with limited mobility such as the elderly or disabled. A walkable city should be safe, connected and attractive. Everyday life should be possible without a car or motorcycle. The urban environment must be easy to navigate, where walking routes are direct, and destinations and nodes are linked with easily viewed urban spaces.

Local planning documents should include a pedestrian traffic strategy aimed at identifying the main pedestrian thoroughfares to provide input for balancing between other prioritized modes of transport. The plans must identify a pedestrian network, and places where the transport capacity and attractiveness of the street can be increased by raising the priority of pedestrian traffic. In order to provide safe and attractive conditions for pedestrians and cyclists, the detailed design of new streets, and the reconstruction of existing ones, should enable and facilitate travel by foot, public transport and bicycle.

The Urban Planning Code (UPC) provides general standards for the management of pedestrian traffic. Among other things, the UPC indicates that urban residential zones shall be designed in a way to provide for: walkable urban space, a continuous network of sidewalks, preferably on both sides, for all urban roads, the ability to cross wide streets at intersections and close to places that are used for social gatherings, inter-visibility between pedestrians and emerging vehicles where roads cross with sidewalks and pedestrian walkways. Additionally, the UPC emphasizes that all local distributor roads and access roads in urban residential zones have to operate at low speed (below 30 km/hour) to ensure the safety and security of pedestrians.

³⁶ European Platform on Sustainable Urban Mobility Plans – European Commission. Guidelines for Developing and Implementing a Sustainable Urban Mobility Plan. Brussels.

What are the key steps to develop a sustainable mobility strategy?

In general, a local sustainable urban mobility strategy has to be established according to four steps:

1. Analyze transport system conditions

Conduct a conditions analysis of the transport system in a way that defines the current service condition of roads, the level of public transport on offer, and the modal distribution for commuting in the secondary city concerned. This step is essential to understand the baseline situation and outline the targets for growth.

2. Forecast future conditions and perform the needs analysis

Strategies are future oriented. At this step, the prospective urban development plan – which is based on demographic projections – should be analyzed in order to identify the future needs of the secondary city with regard to mobility. Normally, urban planning and mobility planning should be an integrated process undertaken by a unified team made of urban development and transport experts. The evaluation of transport demand should be based on historical trends, demographics projections, and a socioeconomic forecast.

At this step a clear linkage exists between the planned urban extension of a city and the provision of public transport services. For example, a new industrial zone should become a key destination to be served by public transport in the sustainable urban mobility strategy. Also, the demand analysis should identify all perceived mobility issues, impediments, and opportunities in the secondary city. For example, if a section of roadway is thought to be unsafe and safety improvements are proposed, a detailed accident history should be compiled to support the assessment.

3. Set priorities

Urban transport needs typically outweigh expected revenues from the sector. As such, it is important to prioritize the needs identified in planning process. Given the often overwhelming number of potential improvements it is important that the planning process has an agreed upon approach to project prioritization.

For example, improving the public transport conditions in a congested area has a greater impact than doing it on the outskirts of the city. Normally, a transport prioritization process should use several criteria (such as safety, quality-of-life, efficiency, benefit-cost, etc.).

The key success factors for setting priorities are:

- Establish formal prioritization criteria and apply these consistently.
- Apply the prioritization criteria to all projects.
- Make efforts to use the same prioritization criteria as those used to develop the national transport plan.

4. Identify the key actions and mobility solutions

The core of a sustainable urban mobility plan consists in the identification of actions that will be implemented for improving the transport conditions of persons and goods in a secondary city. Identified actions should be answers to the current and prospective needs associated with urban growth. The proposed mobility solutions have to be in accordance with the demographics projections and the priorities set previously



Guideline 3: Plan and phase-in the implementation of a public transport system

Public transport should be the backbone of a secondary cities' transport system. This requires planning and implementing a public transport system that has sufficient capacity, and that provides mobility options for journeys to and from the poles of activity. Public transport is key to increase the transport capacity of city's streets and roads: during peak hours, it may take 60 cars to carry 75 people, whereby the same number of passengers can be carried by just one bus.

Currently, no secondary city has a public transport system and the motorization level is very low. Most inhabitants rely on non-motorized modes or motorcycles for their daily commute. However, any increase in the size of the population will have an impact on the progressive dispersion of activities in a territory. Moreover, any increase in the average wealth of households could increase the number of cars in the secondary cities.

Planning ahead for the implementation of a public transport system in each secondary city gives the opportunity to acquire the needed space for the road infrastructure. The road development should include characteristics such as planning bus routes, bus lanes with respective space for other vehicles, and designated bus stop areas for safe boarding of passengers.

Increasing the sustainability level of a city in terms of mobility takes time. As such, the mobility solutions proposed should be part of a 'hierarchy of actions' that will help step-by-step to slow the motorization process.

For example in secondary cities, developing a light-rail service is currently not an option, as the urban density of the city is not high enough and is costly. However, after developing a first bus or minibus system, the implementation of bus-only lanes on some congested roads in the city centre constitutes a first step toward green mobility. The increase of urban density and reaching maximum capacity of the bus and minibus system will eventually require a more organized public transport infrastructure such as a BRT (Bus Rapid Transit). Over

the years, when the BRT will reach its full capacity other options such as light-rail will become more appropriate.

For secondary cities, the implementation of a public transport system would have to follow the following steps:

- Identification of key destinations and designation of routes – this can be phased over time in order to follow the urbanization process
- Definition of the level of service expected
- Agreement with a private partner for operation of the service

Figure 17 on next page illustrates an example of a plan of a public transport system for a small city. Two bus routes follow as much as possible primary and secondary distribution roads and link all the areas of the city.

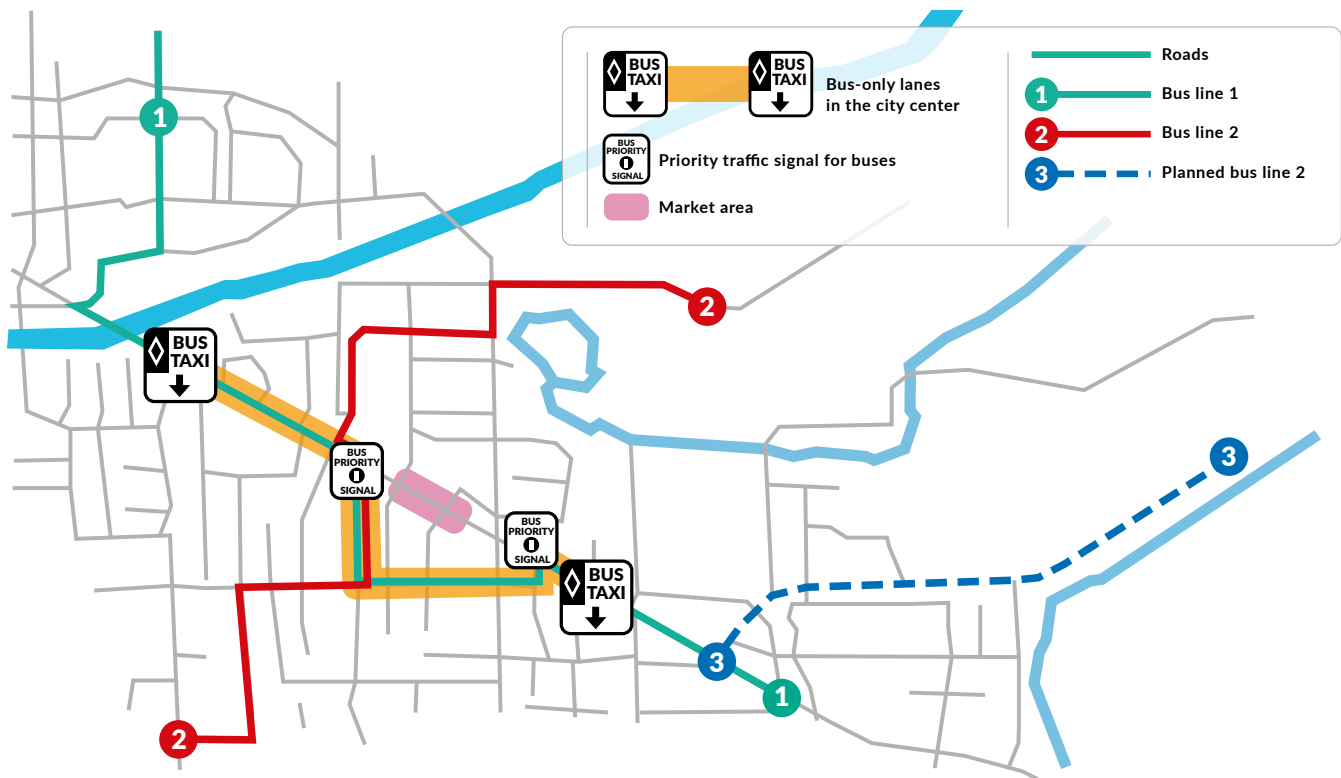
The two routes connect in the centre of the city in order to provide easy exchange for riders from one route to the other. Considering prospective growth, a third route is planned in order to provide service for a new neighbourhood.

The pace of expansion of the system must be coordinated with other construction projects to benefit from any possible synergies and to minimize unnecessary disruption for other road users and street functions.

In the centre of the city, the routes are planned in order to avoid the most congested areas - in this case the market. At this junction, the routes use a side street and avoid the central and congested area. Also, in the centre of the city, bus-only lanes are planned on a section of the road network so that public transport vehicles are not blocked by congestion.

Bus-only lanes are sign-posted or marked as bus only lanes and no other vehicles are permitted to travel or stop on them. The only exceptions might be taxis or authorized special purpose vehicles. A continuous white line generally separates a bus only lane from a general traffic lane. A bus-lane can be effective 24 hours a day, but could also be limited to specific hours such as accommodating to peak and non-peak hours. It is important that lanes are efficiently monitored to ensure benefits are truly captured. Enhanced monitoring means policing bad behavior, such as car-drivers who might wish to take advantage of an empty bus lane to avoid traffic.

**FIGURE 17:
PLANNING A PUBLIC TRANSPORT SYSTEM**



One low-technology measure such as priority traffic signals could be installed at busy intersections in order to prioritize movement of buses.

Figure 18 on the next page illustrates what can be done to improve the speed of vehicles, and consequently reduce their fuel-consumption, where a bus that has stopped in traffic is consuming more fuel rather than providing a reliable service. In a congested city, the efficiency of a public transport system relies mostly on the commercial speed of a given area.

The commercial speed is defined as the combination of (i) boarding time for a vehicle load, (ii) the acceleration given the route topography, and (iii) the speed given congestion obstacles. If a bus is jammed in a congested area, users will try to find an alternative mode of transport – either motorcycles or car.

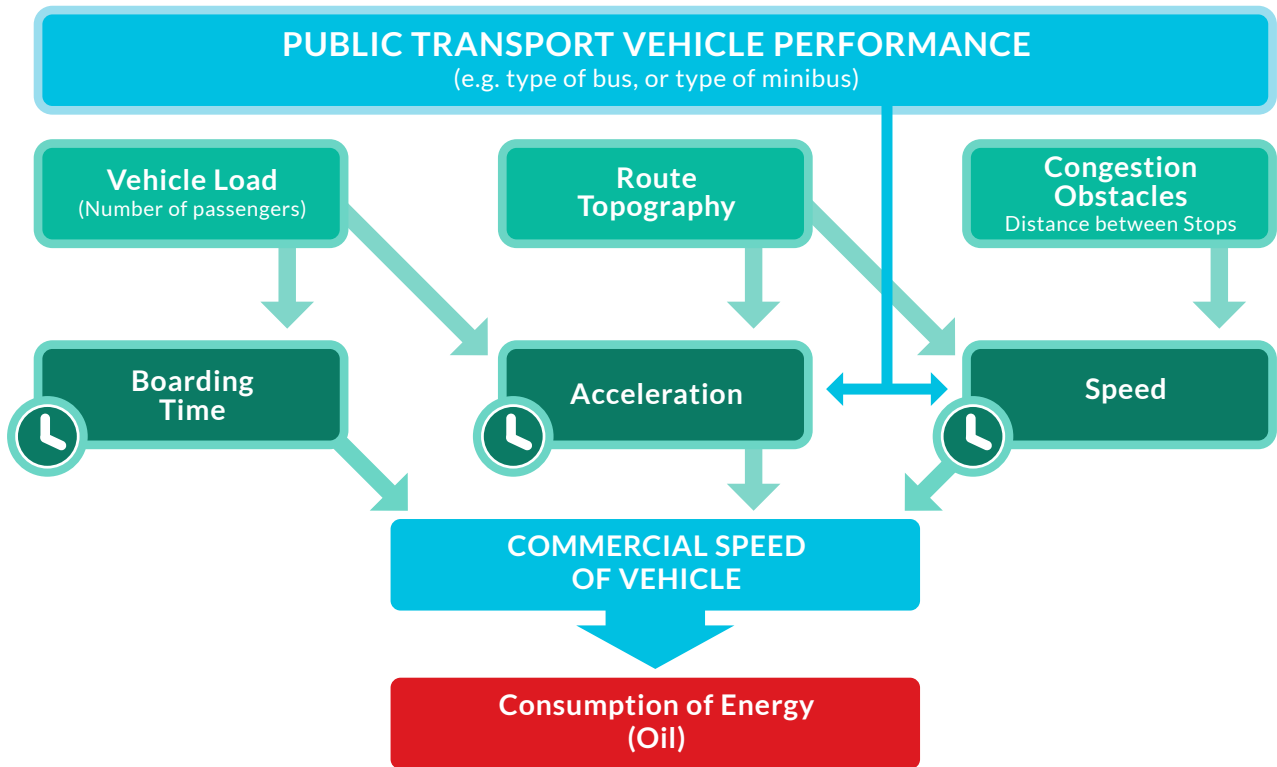
Taking the bus has to be an attractive alternative to buying a car. Therefore the commercial speed of public transport vehicles is a strong indicator for the performance of a public transport system. Moreover, analyzing the average speed of buses provides a good insight into key actions

that could be undertaken to improve the efficiency of a system.

Principally, the speed of vehicles could be improved from:

- Improving the boarding of passengers in regard to time efficiency
- Selecting routes based on road conditions (topography, pavement, etc.)
- Implementing measures to minimize impacts of congestion (bus-only lanes, priority traffic signal for buses, etc.)

FIGURE 18:
PUBLIC TRANSPORT PERFORMANCE



Based on international standards, a new public transport system in secondary cities should be developed in aims of reaching an average speed performance of 15 kilometres per hour, by prioritizing public transport over other road users and stationary traffic.

Guideline 4:
Design an efficient and hierarchized road network

A large part of transportation is performed by motor vehicles, which is necessary for a city’s basic function and should therefore be supported. The development of a road network requires a lot of investment, mostly from public sources. As such, determining investment priorities is essential in the context of rapid urbanization. This prioritization process should be part of a sustainable urban mobility plan, and in turn be integrated in the city planning.

In terms of defining the types of road and their hierarchy, the Urban Planning Code defines that inner-urban and inner-settlement roads shall have the following naming and hierarchy:

- Primary distributor road: distribution of traffic between central and nodal business districts
- Secondary distributor road: distribution of traffic between different neighbourhood areas
- Local distributor road: distribution of traffic within different neighbourhood area
- Access road: link to individual plots, buildings and open spaces to a local distributor road.

The UPC does not define standards for the width of roads based on users. However, it provides guidance on the width of lanes for cars and trucks for all roads in the standardized hierarchy. In order to help secondary cities to plan infrastructure in accordance with UPC and with respect to minimal space requirement for implementing public transport and pedestrian sidewalks, the following figures illustrate generic street sections based on the provisions of UPC.

Investment priorities in roads should follow the same hierarchy as the one provided for by UPC: the primary distributor roads should be prioritized for construction or reconstruction, then the secondary distributor roads, then the local roads, etc.

Moreover, a higher priority should be given to roads that are servicing public transport routes and roads that give access to key infrastructure. Figure 19 below shows a conceptual road prioritization framework for a generic city. The primary distributor road that goes through the city is defined as 'Road Priority 1' considering its strategic importance for urban mobility. Similarly, the roads that give access to a hospital or a stadium are also considered priority 1 and should get priority of investment. A second level of priority shall be given to secondary distributor roads that link neighbourhoods and roads that give access to important infrastructure such as a water treatment plant or a landfill.

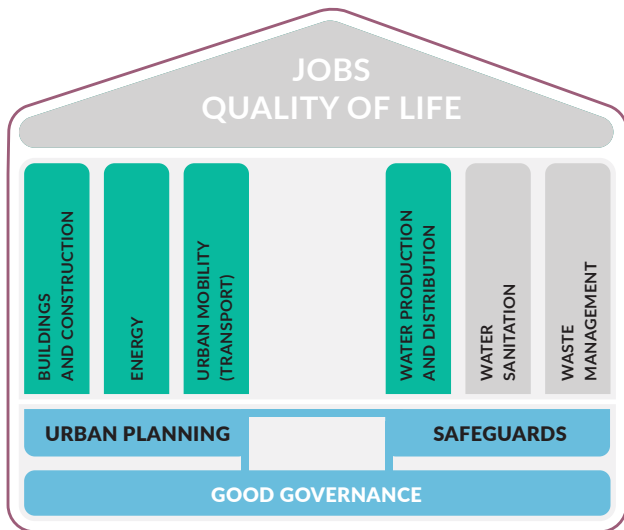
In terms of deciding when to pave a road or not, the National Strategic Transport Master Plan provides guidance on the factors that influence the decision to pave a road in order to increase its operating speed.

Based on international standards, traffic should be the primary factor in deciding to pave or not. Gravel road maintenance costs per kilometer increase considerably after an average daily traffic (ADT) level of 200 vehicles per day. A paving decision should be made based on traffic data, construction and maintenance costs, and the potential of growth opportunity of a given area.

**FIGURE 19:
PRIORITIZATION OF A ROAD NETWORK**







5.4 Water production and distribution

In terms of green growth, access to improved water is crucial as it is a fundamental resource for survival for inhabitants along with the environment. Improving access to water should go hand in hand with the provision of reliable, affordable, and adequate quantity of the resource itself in a timely manner. All in all, it is the only way to support a sustainable urbanization process.

Access to drinking water is a fundamental need and a human right for survival. The health and economic benefits of improved water supply to households and individuals are well documented. Access to improved water is a fundamental of urbanization, as it provides a basis for higher population density and allows sustainable economic development.

In terms of green urbanization a long-term view towards water sufficiency is strategic and a key to reduce poverty and maintain healthy greenery. The availability of sufficient and reliable water supply is a crucial element for the economic sectors' productivity.

5.4.1 Green growth and access to water

Water sustainability can be defined as achieving water access security through the continual supply of clean water for humans and other living forms for life. Sustainable access to water consists of two components:

Environmental sustainability

Environmental protection through limiting the extraction of water to a capacity below or equal to what is actually available, where the renewable water sources must be used no faster than the rate at which they regenerate whilst considering the impact to its corresponding surrounding environment.

Functional sustainability

Sustainability in terms of supply and management means that water is made available to residents and industry in terms of the quantity and quality they require with the assumption that it is consumed efficiently. The following operational rules define the condition of sustainable urban water management:

- Water for consumption by residents and industry is supplied from a range of diverse sources (not just one centralized source), to provide water security in times of drought.
- The ecological values of water sources and surrounding areas are protected.
- The city has a much lower carbon footprint, because the management of resources, such as water, sanitation, energy and food production, are fully integrated.

Green technology options for water supply are crucial to: tackle the national constraints of water supply; mitigate the carbon emissions associated with the value chain of supplying the water; account for water issues caused by climate change to build resiliency against it; and maintain hygiene standards for the end users in consideration of public and environmental health. Table 14 on next page shows the impact of consuming renewable resources, such as water, where it shows the combination of (i) consumption of renewable resources and (ii) state of the environment needed to achieve a certain sustainability level.

**TABLE 14:
IMPACT OF RENEWABLE RESOURCES CONSUMPTION**

CONSUMPTION OF RENEWABLE RESOURCES	STATE OF THE ENVIRONMENT	SUSTAINABILITY LEVEL
More than nature's ability to replenish	Environmental degradation	Not sustainable
Equal to nature's ability to replenish	Environmental equilibrium	Steady-state sustainable
Less than nature's ability to replenish	Environmental renewal	Sustainable development

5.4.2 Water needs per capita based on international standards

According to WHO guidelines³⁷, water supply is deemed sufficient and adequate for a person if it is regular and sufficient for personal and domestic use. Personal and domestic use includes water for: drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene. As per shown in Table 15 below, this equates to 50-100 liters of daily consumption person, and 20 liters as an absolute minimum³⁸.

The Rwandan National Policy & Strategy for Water Supply and Sanitation Services estimates that the standard required consumption in Rwanda is 20 liters per person per day.

Based on the Rwandan National Policy & Strategy for Water Supply and Sanitation Services, 20 liters per-capita per day will be used as the 'basic need' for urbanization of secondary cities. The current access rate for domestic water consumption is 6-8 liters per day. Rapid urbanization and large-scale housing developments coupled with increasing economic activities, is likely to increase demand for water use.

**TABLE 15:
WHO GUIDELINES ON AVERAGE WATER USE**

WATER USE (LITERS / Liters / Per-Capita / Per-Day)			
Region	Average	Minimum	Maximum
Developed Countries	307	130	578
Newly Industrialized Countries	199	86	366
Developing Countries	44	4	400
African Countries - Rural	31	5	100
WHO Standard	50	20	100

Source: World Health Organization. Guidelines for drinking water quality.

³⁷ WHO Guidelines for Drinking Water Quality are available at: http://www.who.int/water_sanitation_health/dwq/gdwq3/en/ This translates to 50 to 100 liters per person per day, with an absolute minimum of 20 liters per person per day in emergency situations.

³⁸ Guy Howard and Jamie Bartram, Domestic Water Quantity, Service Level and Health. World Health Organization. Geneva, 2003.

5.4.2 National context of Rwanda with regards to access to improved water

Rwanda's water supply sector has experienced dramatic improvements in service, sustainability, and coverage since sector reforms began in 2000. The National Policy and Strategy for Water Supply and Sanitation Services³⁹ was adopted in 2004 and revised in 2010. Also, a National Policy for Resource Management⁴⁰ was adopted in 2011.

The **Third Integrated Household Living Conditions Survey (EICV3)**, reported that 25.7% of Rwandans use piped water, but only 5.9 % have access to it within their house or plot (urban: 27.8%, rural: 2.1%). On average, household members in Rwanda (women and children) spend 17.4 minutes travelling to a main water source (rural: 18.1 minutes, urban: 13.3 minutes), which includes both improved and unimproved sources combined.

Currently, 75.2% of the population in Rwanda have access to a clean water source, this is segregated into 79% in urban areas and 69% in rural areas.

Daily per capita consumption is currently 13 liters per day, far lower than the WHO average consumption of 50 liters per day per person. Additionally, where water is accessible from unprotected sources, which are easily and freely available, a part of the population tends to use these sources, although this is often for purposes other than human consumption such as for hygiene or clothes washing.

³⁹ This policy ensures access to safer water, sanitation and sustainable waste management services for all Rwandans, in order to contribute not only to public health but also to economic development and poverty reduction. This policy not only intends to provide basic needs such as access to sanitation but also to mitigate impacts on the environment and therefore is favouring green growth.

⁴⁰ The main objective of this policy is to ensure water resources are preserved and managed in a sustainable way without comprising the environmental needs of the present and future generations.

The **Water and Sanitation Sector Strategic Plan 2013/14–2017/18** was adopted in 2013 to detail actions for meeting targets outlined in EDPRS 2. The Government has a target to achieve 100% access to clean and safe water to all citizens by the end of the year 2020.

On its side, the **National Policy and Strategy for Water Supply and Sanitation Services**, reports that the main challenges in urban water supply are cost recovery and improved planning. On this second point the Policy remarks that urbanization and infrastructure development need to be planned in collaboration between the utility and the urban authorities in order to be successful. Long-term strategic planning is required to mobilize the investments needed to satisfy the water needs under fast country urbanization, notably secondary cities. The Policy indicates that dedicated efforts are needed to raise service levels and to ensure service delivery to the urban poor. For urban water supply, the specific objective the Policy is to “ensure safe, reliable and affordable urban water supply services for all while strengthening the financial viability of the Utility”. In addition to the policy and strategy, national drinking water quality standards have been established, and are the same as the WHO Guidelines.

The **National Strategy for Climate Change and Low Carbon Development** lists the challenges associated with sustainable water management in Rwanda (rapid population growth, increased urbanization and industrialization, environmental degradation and pollution leading to depletion and degradation of water resources, climate change, etc.). In order to ensure sustainable water for development, this **National Strategy** recommends to:

Establish a national integrated water resource management framework that incorporates district and community-based catchment management
Develop water resource models, improved meteorological services, water quality testing, and improved hydro-related information management
Develop a National Water Security Plan to employ water storage and harvesting, water conservation practices, efficient irrigation, and other water efficient technologies.

WASAC provides urban water supply services in 14 towns, including the CoK. Service coverage within the contiguous built-up urban area is generally reasonable while peri-urban areas are not always well served. Most urban dwellers do not have access to piped water, with roughly 32% of the urban population connected to piped water.

Most urban water networks of Rwanda have exceeded their useful lifespan, and this impacts service delivery in terms of quality, reliability, and meeting water demand. Notably, on average, 45% of the water produced is not billed, often as a result of pipe leaks (technical losses), and small commercial losses.

The need for new water treatment capacity is especially acute in some secondary cities, notably Huye, Musanze and Rusizi.

5.4.3 Prospective needs of secondary cities in terms of water

Table 16 on next page shows the water required to accommodate demographic growth projections for secondary cities. The needs in terms of potable water are established on the basis of 20 liters per person per day, which is a minimum standard for human needs based on WHO standards, but also the standard of the Rwandan National Policy & Strategy for Water Supply and Sanitation Services. The table shows current needs

**TABLE 16:
PROSPECTIVE WATER NEEDS OF SECONDARY CITIES**

CITY	HUYE		MUHANGA		NYAGATARE		RUBAVU		MUSANZE		RUSIZI	
	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020
Urban Population	52,768	103,654	50,608	111,901	47,480	181,600	149,209	421,124	102,082	236,638	63,258	137,315
WHO Standard (9 m ² / person)	1,055 m ³	2,073 m ³	1,012 m ³	2,238 m ³	950 m ³	3,632 m ³	2,984 m ³	8,422 m ³	2,041 m ³	4,733 m ³	1,265 m ³	2,746 m ³

(based on 2012 demographic data), and prospective needs for each secondary city. It is prominent that on average every secondary city will need at least double the amount of water in 2020 compared to that of 2012. Therefore the provision of additional water and improving current inefficiencies is crucial.

5.4.4 Green guidelines for water production and distribution

Access to potable water is an essential pillar for the urbanization of secondary cities of Rwanda. A lack of water or difficulties to access it for urban dwellers is an obstacle to urban development. As water is an essential need for human life, the level of water provision has a direct impact on the economic vitality of a city and its growth potential. Additionally, the provision of clean and potable water is also key for long-term urban sustainability.

Actions are possible at each level of the water cycle in order to accelerate green growth. As such, districts, ministries and agencies can intervene directly in the management, production, distribution, and consumption of potable water.

The following green guidelines for water should be integrated in the planning and the development process of secondary cities.



Guideline 1:
Preserve and protect water sources

Virtually every stream, lake, river and aquifer in Rwanda could be used as a drinking water source. Protecting these water sources from contaminants is a major priority in protecting public health, through ensuring a clean, safe drinking water supply. This reduces the threat of waterborne illnesses and helps to minimize costs incurred by water treatment prior to distribution to households.

The development of green secondary cities will be achieved only if water is supplied and is accessible to all inhabitants and the natural environment. The previous section underlined the substantial quantity of water that is required by rapid urbanization.

This increased demand poses a growing threat to the cities surrounding water sources. Therefore, having a plan for water management is a sound strategy and was identified as a key action of the **National Strategy for Climate Change and Low Carbon Development** : it established a nationally integrated water resource management framework that incorporates district and community-based catchment management.

Considering the strategic significance of secondary cities for the development of Rwanda, these territories should be prioritized for the adoption of a **local water resource management framework**.



Guideline 2:
Ensure access to improved water for all

Access to clean water is essential to support the basic needs for human life and provide a sustainable framework for economic development. Considering the needs of secondary cities based on demographic projections new water production capacity will be required in order to sustain growth and create livable cities.

Access to water is also critical in terms of gender equity and poverty reduction. Generally, women are the ones who travel long distances to meet their families' water needs. Conversely, women and children benefit most when services are improved. The distance to a water source poses a significant burden on women and this impacts on the quality of their lives and their economic prosperity. In addition, development of water points favouring the safety of users (with better lighting and no shadow areas), will enhance safety of accessibility for all, including women.

Currently access to improved water in districts of Nyagatare, Musanze and Rusizi is below the national average and requires substantial investment. Moreover, as shown in table 17 below, the way to have access to improved water is different from one district to another. For example, in the district of Rubavu, 40% of households that have access to improved water have direct piping in to their dwelling. On the other hand, only 24% of households in the district of Huye with access to improved water have direct piping.

TABLE 17:
ACCESS TO WATER (IMPROVED WATER)

CITY	HUYE	MUHANGA	MUSANZE	NYAGATARE	RUBAVU	RUSIZI
Protected Springs	56%	64%	2%	0%	0%	36%
Public Standpipe	20%	13%	64%	14%	60%	37%
Piping to dwelling / yard	24%	23%	34%	86%	40%	27%

What are the key steps to develop a local water resource management framework ?

In general, a local water resource management framework has to be established according to three steps:

1. Delimitate the drinking water source protection areas

Delimitating the water source protection areas show that the areas are protected, and also prescribes the boundaries from which water supplies are drawn. The areas identified will be the territory within which contaminant source inventories can be made; identifying substances or activities that may pose potential risks to the drinking water supplies.

Delimitation can be performed using multiple methods, and are most protective when they include all sources of water, potential contaminants, and activities affecting them within the prescribed area. Each water source, protected or unprotected, open wells to surface water bodies, should be identified.

2. Make an inventory of known and potential sources of contamination within the protection areas

The source inventory lists all documented and potential contaminant activities of concern that may be potential threats for drinking water supplies. The source inventory should indicate the risk level of each potential contaminant, identify management measures, and then rank and prioritize them according to the most risky in order to reduce or eliminate the risks.

Once potential sources of contamination have been identified, threats should be analyzed based on the potency or the toxicity of the contaminant, the volume of discharge or release, the distance from wells or intakes, and the likelihood of entry of the contaminant into the source waters.

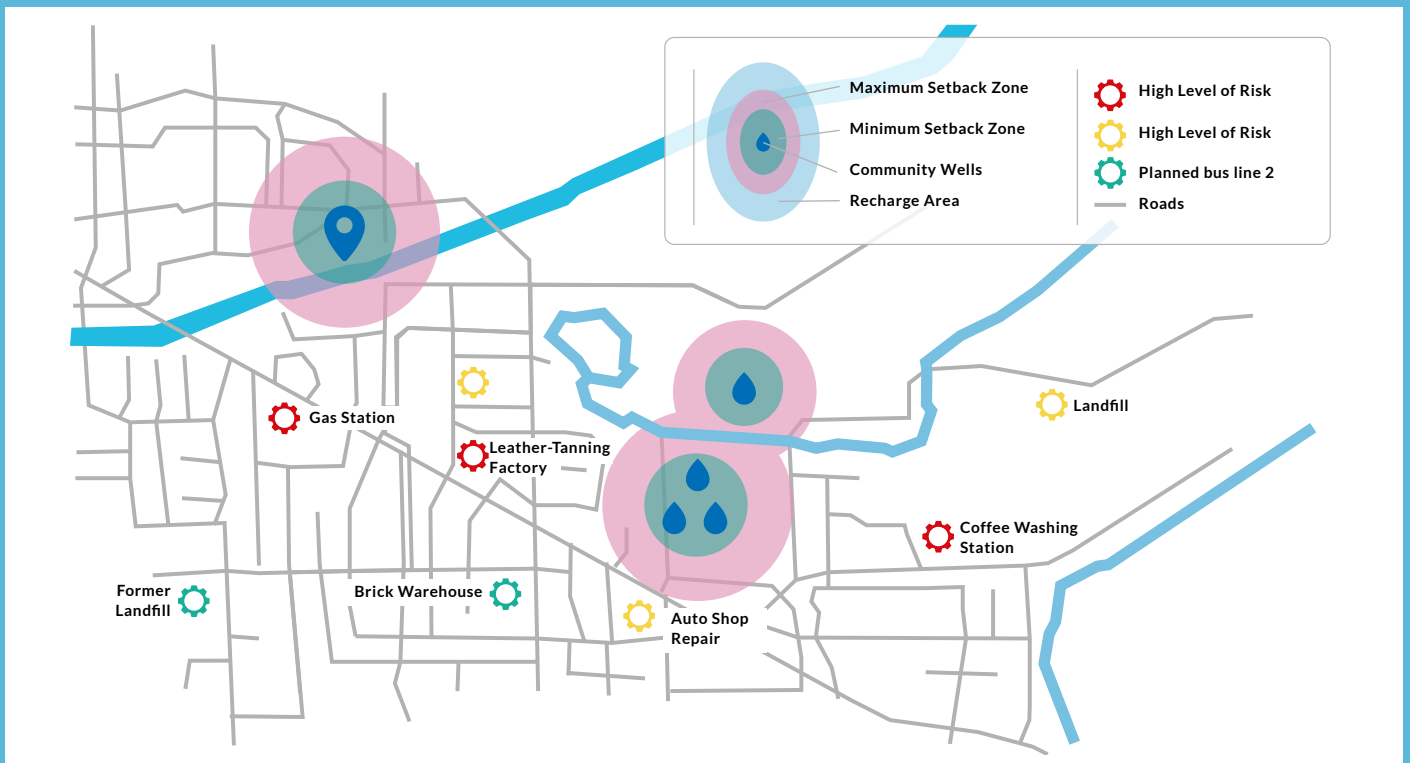
If contamination of a source is effective (for example, a spring is contaminated by an informal landfill) the public should be notified in order to control and modify their own actions to prevent illness and further contamination.

3. Implement measures to prevent, reduce or eliminate threats to water resource

Following the identification and the analysis of potential sources of contamination, specific management measures should be put in place. For example, this could take place by the implementation of used water recycling technologies in a coffee washing station, or the relocation of a leather-tanning factory outside of the protected areas of a drinking water source.

The following figure provides an example the three steps for establishing a local water resource management framework

FIGURE 20:
EXAMPLE OF A DELIMITATION OF A SOURCE WATER PROTECTION AREA AND IDENTIFICATION OF CONTAMINATION THREATS



Water production facilities of the district of Rubavu

Indicator 8b of EDPRS 2 states that all urban households should be within 200m of an improved water source. Therefore, two recommended actions need to be undertaken in the planning process of secondary cities to make that a reality.

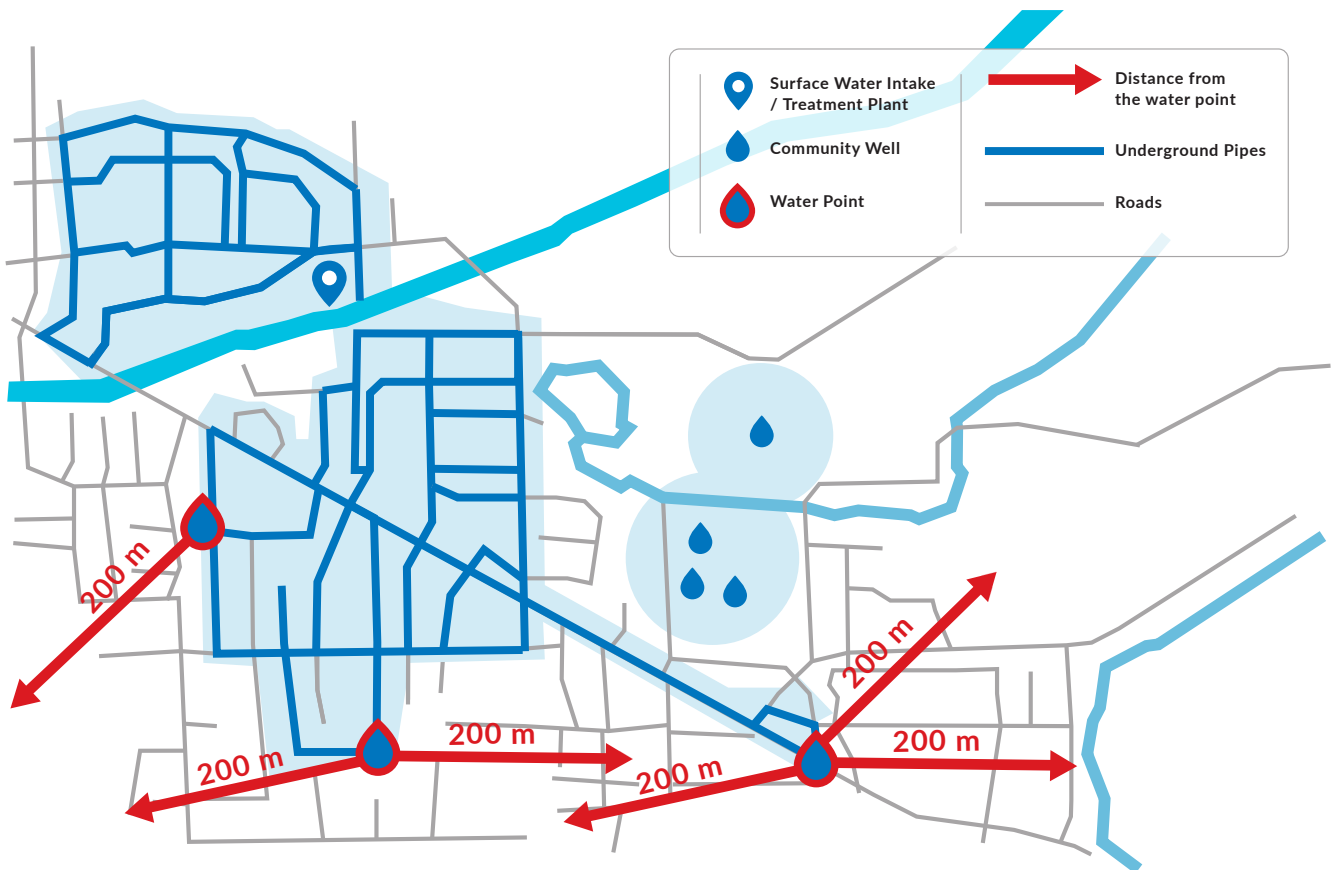
Firstly, the areas to be served by a public water system should be identified and based on the identification of surface or ground water availability. The level of availability of the water to be distributed in a public network must consider the natural regeneration capacity of each water source (based on rain trends, hydrological data, and nature of soils). A public water system should be planned in the densest area of a secondary city and take in consideration the potential for economic development.

Secondly, for the areas that are not planned to be served by a public water system, a planning of water points / boreholes and protected spring should be undertaken in order to ensure that any new household is less than 200 meters from a source of improved water. Such an approach will contribute to achieve the targets of EDPRS 2 in each secondary city.

Figure 21 on next page shows an example of a public water distribution system. The main source of the supply is along the river, and from this point the water is treated and then distributed into pipes of the public water system. In order to ensure access for all households, water points are planned strategically at the edge of the public system.

The locations of the water points should be determined based on urban extension vision in order to ensure that any new household is located within a 200m radius and therefore has access to improved water.

**FIGURE 21:
PLANNING ACCESS TO IMPROVED WATER**





Guideline 3: Improve the sustainability of water treatment

A water treatment plant associated with a public water system is generally one of the largest consumers of energy in a city. If energy supplying the plant is produced with non-renewable resource (such as diesel or coal) the sustainability level of the production of clean water would be low and the carbon emissions would be high. In order to make water production more sustainable, different strategies can be explored.

A good Rwandan example of efficient water production was planned by the Manna Energy Foundation, which attempted to use carbon credits from the Clean Development Mechanism (CDM) to finance the implementation of water purification systems in four water pipelines that serve approximately 7,750 people. Each system uses a photovoltaic (PV) solar panel, combined with other solar technology to power the system. This innovative project provides a useful model for implementing green strategies for large energy consumers, such as a water treatment plants.

Also, significant gains in terms sustainability can be achieved through households that are not directly connected to the public water system. Notably, for the majority of households in Rwanda, the prevailing practice to get potable water is to boil it by burning biomass. This practice is carbon intensive and uses a lot of resources.

However, many water purification technologies exist that could reduce this thermal energy need. Zero energy water purifiers for safe drinking water and low GHG emitting water purification systems are available. A recent project in India provided a private water purification system to thousands of households for \$15 per unit. A million of these systems can generate a carbon offset of over 250,000 tons of CO₂ per year.



Guideline 4: Improve the efficiency of the water distribution system

Every water system is situated by a water source, whether it is from the ground or from the surface (lake or river), to extract the water itself. However, not all the water reaches the households as a large proportion of the water is wasted through pipe leaks whilst travelling to the end-user.

Zero losses are unrealistic, given the pipes, valves, connections and fixtures that are associated with any public water system. Therefore improving the efficiency of the water distribution can provide major gains in terms of sustainability. Leakages in the distribution system require more water to be pumped and treated, which requires additional energy and chemical usage, resulting in wasted resources and excess pumping capacity. If the water distribution system is efficient, more clean water is distributed to households and less water has to be treated, meaning less energy is needed for water treatment, and less water is removed from the environment for human activities. Therefore, improving the efficiency of a water system and minimizing losses have a major impact on the quantity of resource required to sustain urbanization in a green way.

One way of identifying the significance of water losses in a water system is to look at non-revenue water, which is the difference between water produced and water billed.

For example, in the City of Kigali for the period between July 1st 2010 and June 30th 2013, 101,171,777 cubic meters of clean water were produced, and only 52,923,647 cubic meters charged. Therefore the quantity of non-revenue water (unbilled water) amounted to 38,248,128 cubic meters, representing 37.8 % of the water produced.

Some water facilities and part of the water distribution network in CoK were constructed during the 1930s. The facilities have been upgraded overtime and new infrastructure was constructed in 1952, 1975, 1988, 2003 and 2010. The pipes are mostly made of cast iron, galvanized steel, polyvinyl chloride and polyethylene.

These materials are resistant but they suffer from degradation due to time and environmental conditions that causes corrosion and leakage through the system. Therefore repetitive leakages are frequent and likely explain most of the 37.8% water losses, and impact on the quality of distributed water.

A two-steps approach should be undertaken in order to improve the efficiency of the water distribution system. Firstly, a strategy towards the **improvement of existing public water systems** (network of underground water pipes) should be undertaken in order to minimize losses. Secondly, the planning and design of any new water system in urban areas should be based on using **sustainable materials** targeting long-term efficiency.

The implementation of a water loss control program for areas that are already have piped water can reduce water and revenue loss and can also protect public health by reducing the threat of sanitary defects such as backflow or infiltration, which may allow microbial or other contaminants to enter the water. A water loss control program has to be flexible and tailored to the specific needs and characteristics of a public water system of a secondary city.

In addition, the technical design of water system expansion should be realized with materials and technologies that minimize the possibilities of water leakage in the middle to long term. **With current technologies, it is possible to expect a regular water pipe to last a hundred years without requiring repairs.** As such, the type of material used should be adapted to the local context (characterized by specific soil condition, and specific water infiltration levels). Moreover, connections between pipes are strategic points in a system and commonly major sources of water leakage.

Therefore, at the design phase, a specific attention should be given to these connections and the materials used in order to minimize leaks. In Rwanda, water pipes made of **High Density Poly Ethylene (HDPE)**, with heat fused connections are available and minimize leaks.



Guideline 5: **Optimize the consumption of clean water**

The end users of clean water, households and industries, directly affect the sustainability levels of urban water. The quantity of water used i.e. the 'demand', defines the quantity of water that is to be supplied and treated, and therefore the quantity of energy, chemical products, and raw water required to carry out that service.

Several strategies could be implemented in order to reduce the demand for water from end-users, in respect to the minimal standards of WHO. It should be noted that a demand-side management approach to reducing demand should be applied mainly to large water consumers (such as industries, breweries and coffee washing stations) and over-consuming households (for example households that consume more than 100 liters per day per person).

Households consuming less than the World Health Organization standards should not be penalized by a demand-reduction strategy.

Four main strategies are available on the demand-side in order to reduce consumption of households and industries: **education, water-efficient appliances and equipment, rainwater harvesting, and water use regulation and pricing.**

Understanding the rationale of minimizing the use of water is a first step toward sustainable consumption. For this purpose, education of the general public through awareness campaigns targeting middle and high-income households could have a significant impact on the consumption of residential end-users.

Another way to minimize consumption of clean water is to promote the use of water-efficient devices in houses. A water efficient device is one that serves the same function as a standard device, without any reduction in performance, while using less water. More details on water-efficient devices are provided for in the guidelines for green buildings section.

For industries, using less water could be achieved by changing production practices. Notably, industrialization is a key driver for water demand. Currently, the vast

majority of manufacturing industries in Rwanda are located in CoK and in Ruvabu. Therefore most industrial water demand comes from these two cities, especially for agro-processing factories. However, urbanization and job creation will bring more economic activities to secondary cities, further increasing the demand for water. One such example can be found in Rwanda's fastest growing industry: the production of fully washed coffee. This economic activity generates jobs and wealth but is both an intense water user and polluter. In order to minimize consumption in industries, new approaches such as water recycling need to be put forward.

A third strategy to minimize water use is to **promote water harvesting for all buildings**. Rwanda has a bi-modal rainfall pattern with average annual rainfall of 1280 mm and its climate is temperate-tropical, with an average temperature of 19 degrees Celsius. This climate and the availability of rainfall make rainwater harvesting a potential source of water for various uses in Rwanda. Rainwater harvesting is an affordable solution that has already been implemented all over the country. This green technology has great potential to be replicated.

The benefits in installing rainwater harvesting tanks include controlling water flows that can accumulate and create flooding or even landslides; recycling and control in watering livestock; water for irrigation; and water for domestic use. Rainwater harvesting would act as a key factor for the ideal 'green' housing but would in turn need appropriate tanks with accumulation and deposition facilities.

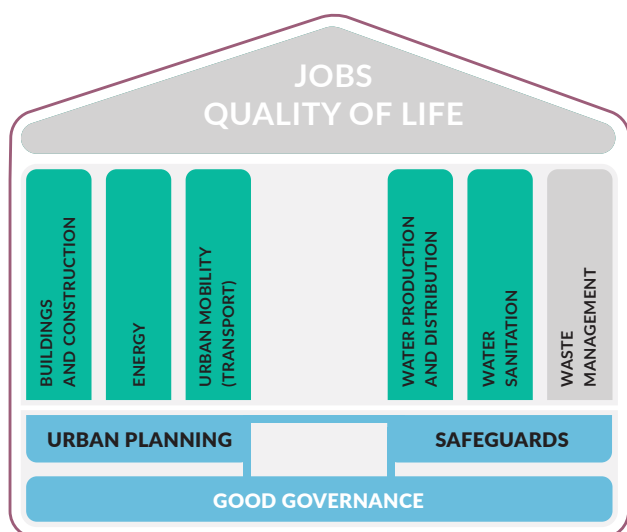
The National Policy and Strategy for Water and Sanitation embellishes the promotion of rainwater catchment systems to complement the source of water for both households and public buildings. Also, the **National Strategy for Climate Change and Low Carbon Development** brings together the national policies and strategies for irrigation, water supply and sanitation, IWRM and energy. The **National Strategy** indicates that Rwanda will investigate available water efficient use and water recycling technologies, and water conservation practices for domestic, industrial and agricultural uses.

Rwanda will mainstream water saving technologies and practices into the planning system, EIA/EMPs and the **Building Code**.

One of the most effective ways to control the quantity of water used by households is **pricing**. Pricing conveys the true value of water and water delivery services to end-users. Using costs of service, user charges are established and water use metering are used for clear customer billings.

Rwanda currently uses a 'block' tariff structure, meaning that prices per cubic meter consumed differ depending on how much you consume. If you consume above a certain threshold each month then you are charged a higher tariff. Such methods encourage efficient water usage.





manage domestic and community hygiene and the disposal of waste water and solid waste. Giving women a greater voice in technology choices and the menu of management and financing options in sanitation services can improve efficiency and effectiveness.

From this perspective, sanitation is an important pillar of urbanization. The development of secondary cities offers a unique opportunity to implement a sustainable sanitation framework and minimize the environmental impact of sludge. Moreover, efficient sanitation offers economic opportunities for low-skilled workers and could help sustain food security by contributing to the agriculture sector as fertilizer, and, as such, should be part of an economic development strategy.

Even incremental steps towards more sustainable management of waste products can lead to improved health and greater economic returns.

5.5 Sanitation

A sanitation system serves to protect and promote human health by providing services to adequately dispose of sewage. As a result, the public benefits from clean environments with reduced risk to diseases.

In order to be sustainable, a sanitation system must be durable, socially acceptable and economically viable. In this way, sustainable sanitation is an approach that differs fundamentally from the concept of wastewater management as it recognizes technology, but also social, environmental and economic aspects. Sustainable sanitation is an approach that considers sanitation holistically: it recognizes that human excreta and wastewater (sludge) are not waste products, but valuable resources.

Currently, the sanitation sector is limited, and there is a need for improvement and innovations, especially in regard to integrating its objectives into other infrastructure objectives to account for urbanization.

Sanitation is closely linked to issues of public health, biological resources, and the environment. Poor sanitation practices negatively impact the health and productivity of the population, and deteriorate the natural resources needed for economic growth – notably water. The **National Gender Policy** addresses the need to “enhance women’s and men’s partnership in the water and sanitation management system”. Women traditionally

5.5.1 Green growth and sanitation

Individually and collectively, humans generate outputs such as excreta and wastewater. The way these outputs are managed have a direct impact on the environment: if stored in the ground, the wastewater can trickle into its surrounding areas and contaminate the soil or water sources; and if stored on the surface, the excreta emits methane that directly contributes to global warming and thus climate change. All in all, sanitation systems need to deal with the unhygienic characteristics and the environmental dangers in order to achieve a green growth path for a city.

The first step toward efficient and sustainable sanitation systems is recognizing that sludge is not waste, but a valuable resource that can be reused and recycled, notably as a fertilizer for agriculture or as a source of energy from methane emissions.

Sustainability criteria for the development of a sanitation system

The development of a sustainable sanitation system has to take into account these basic criteria. These criteria, detailed below, shows the key elements for greening the sanitation system. Consideration of all elements is crucial in order to achieve sustainable and inclusive development.

- **Health and hygiene:** the sanitation system must provide an effective barrier between the user and the environment – it must prevent direct exposure to waste at all points of the sanitation system (i.e. from the toilet to the point of reuse or disposal)
- **Environment and natural resources:** the sanitation system must protect and respect the natural environment and resources. Wherever possible, the resources contained in excreta and wastewater (energy, nutrients, water) should be recycled, thereby protecting other resources (e.g. by replacing fossil fuels through biogas)
- **Technology and operation:** the sustainable sanitation system should use technologies and modes of operation that are well adapted to the local context. The entire system, collection, transport, treatment, and reuse or final disposal, should be constructed, operated and monitored by the local community and locally based technicians. The selection of the technology has to be affordable for most households, financially viable as a utility service, and capable of paying back on the investment made
- **Financial and economic:** the cost of a sanitation system must relate to the ability to pay off households, districts, institutions, and includes not only the costs for construction, but also the costs for operation, maintenance and necessary reinvestments for the system. Economic benefits (job creation, production of soil conditioner, fertilizer, energy, etc.) and external costs (environmental pollution) should also be taken into account
- **Socio-cultural acceptance:** a sanitation system only lasts and can be sustained if the community accepts it. Again, this includes the whole sanitation system; not only toilets, but also maintenance and operation and the recharge and reuse system adopted

Technology selection for a sanitation system

In terms of technology, there is no one-for-all sanitation solution. The selection of the technology to be utilized depends on the local framework, and has to take into consideration the existing environmental, technical, socio-cultural, and economic conditions. In order to achieve higher gains in terms of sustainability, the adoption of a system-based approach to sanitation and planning – shifting the emphasis away from isolated technological inputs to a series of processes that operate from cradle to grave – is recommended.

The planning of a sustainable sanitation system has to be:

- Comprehensive – where all waste streams are considered
- Re-use oriented – where waste has to be looked at as a resource and whenever possible be used beneficially
- Appropriate – providing a comprehensive suite of technology options selected based on their sustainability, rather than implementing the ‘typical solution’
- Context specific – the local framework, characteristics of the city and surrounding area, are all taken into consideration

Improved sanitation facilities are defined in terms of the types of technology and level of services that are more sanitary than if unimproved technologies were utilized. Improved sanitation includes connection to public sewers, connection to septic systems, pour-flush latrines, simple pit latrines and ventilated improved pit latrines. Not considered as improved sanitation, are service or bucket latrines, public latrines and open latrines.

In general, wastewater management and sanitation technologies fall either under the category of conventional waterborne or dry pit systems.

In both cases, the design is based on the premise that excreta is waste, that the waste can be disposed of, and that the environment can safely assimilate the waste.

Pit latrines are mostly designed to retain solids and infiltrate liquids – when liquids infiltrate, nutrients and pathogens also infiltrate. If a toilet is built too close to a water source, it can lead to severe pollution of the surrounding ground and surface waters. The safety of users, particularly women, should be given special attention when such facilities are planned to serve more than one house.

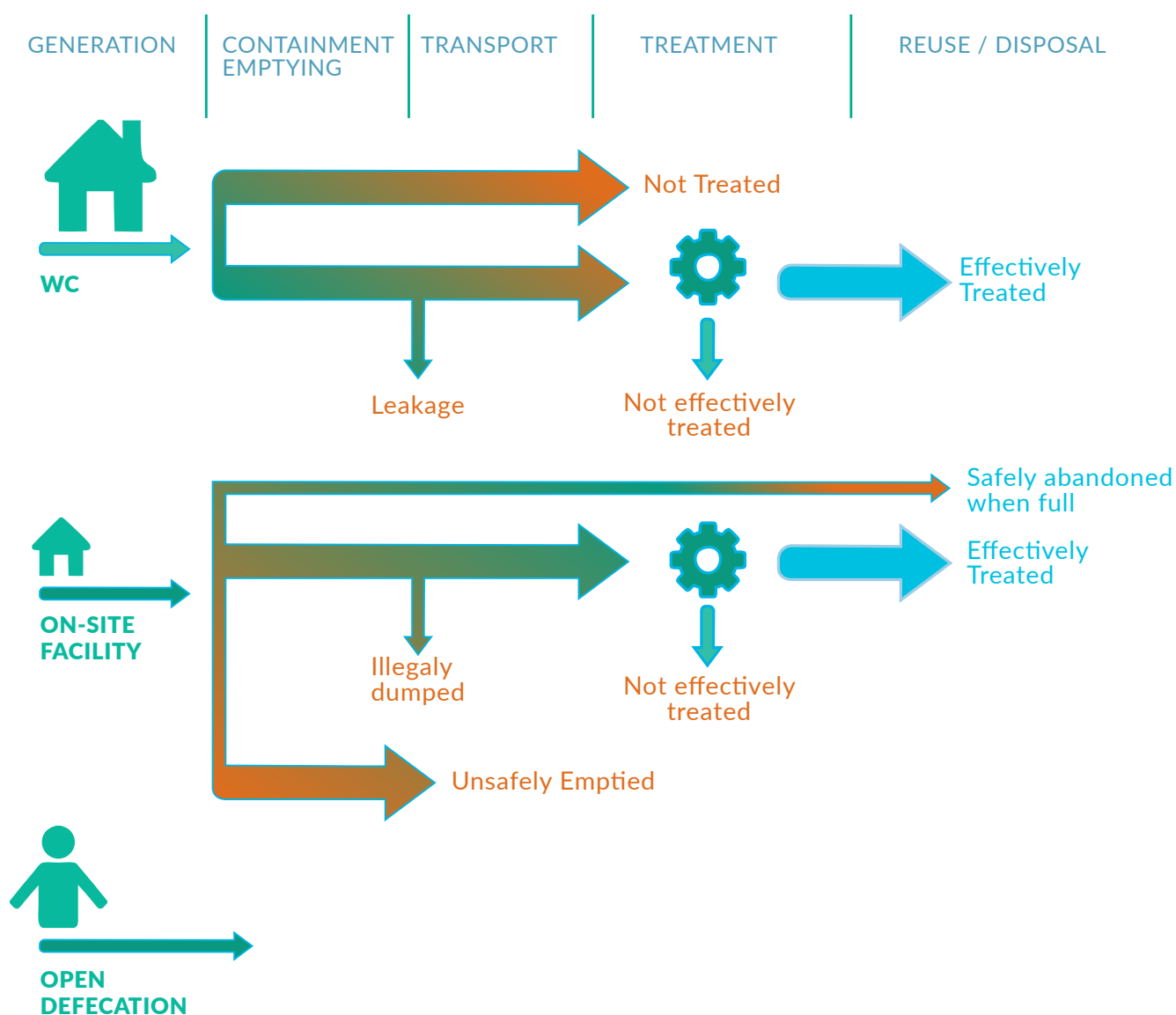
Waterborne systems are based on: the collection of domestic liquid waste in a sewer system; treatment of the wastewater in centralized treatment plants; and disposal of the liquid waste to surface water bodies. These systems are very effective in terms of improving the quality-of-life but also have their drawbacks. A flawed characteristic is the linear “end-of-pipe” systems, which are constructed on the assumption that treatment will take place at the end depository, whilst in most cases the untreated wastewater is disposed in nature.

Figure 22 illustrates the three types of sanitation systems that are typically adopted. The first part shows a waterborne system where excreta and wastewater generated by houses are collected by a sewer network.

If the sludge is not treated and disposed of directly into the environment, the sanitation system becomes unsustainable. If the sludge transported by sewers is effectively treated and reused or disposed correctly, the system becomes sustainable.

The second part illustrates a system that is based on on-site facilities (dry pits). If the facility was carefully located and was managed well through its lifespan, it could be safely abandoned when full. The third option is efficient management of a facility that is emptied on a regular basis. The content can be transported to a treatment facility, then reused or disposed of.

**FIGURE 22:
SANITATION SYSTEMS**



Green economic opportunities

In general, as excreta and wastewater are continuous resources being supplied to the economy, assuming a constant or growing population within that area, a sanitation system has the opportunity to use this resource to contribute to the city's economic growth. Therefore, in regard to investment in this sector, a sanitation system should bring higher rates of return than the initial investment. Urban sanitation systems comprise of a range of processes that represent potential business opportunities, including small-scale service provision for: construction, collection, transport, storage and processing of waste products.

The WHO estimates an average rate of payback in the range of \$3–\$36 for each dollar invested in the sanitation sector. Therefore, providing reliable and affordable sanitation services for all inhabitants of a city should also be seen as a means of accelerating economic growth.

5.5.2 National context of Rwanda with regard to sanitation

Open defecation sanitation systems have mostly been eradicated, where most of Rwandan households have already financed and built an on-site private sanitation on their premises, though only about half comply with the international standard definitions of an improved sanitation facility. Very few Rwandan households have installed flush toilets (1.7%). The prevailing practice remains that water is used for cooking and washing (grey water, discharged mostly on the surface), while the excreta are disposed of with waterless latrines (92.2%), which is a rational solution considering the scarcity of the water supply on average. Rwanda has not yet invested significantly in collective water-borne sanitation systems for densely populated urban areas, except three small sewerage systems in Kigali for about 700 households. Major hotels, hospitals and some industries have installed their own treatment systems underground. A conventional sewerage and treatment system for Kigali's centre is in the planning process.

The National Policy & Strategy for Water Supply and Sanitation Services identified three key objectives with regard to sanitation:

- Raise household sanitation coverage to 65% by 2012 and 100% by 2020, and promote hygiene behavioral change
- Implement improved sanitation for schools, health facilities and other public institutions and locations
- Develop safe, well-regulated and affordable off-site sanitation services for densely populated areas

Based on the objectives of the National Policy, the **Sector Strategic Plan (SSP) on Water and Sanitation 2013/2014-2017/2018** identified that an investment of 54 billion Rwandan Francs (approximately 77 million dollars) is required to achieve 100% coverage of improved sanitation by 2020. However, as stated by the SSP, funding is problematic and new financing solutions are required. A strategic challenge identified by the SSP is the projection and estimation of demand in each district for the next 25 years (based on accurate demographics). The following tasks were identified for the coming years:

- Preparation of a sanitation master plan for all urban areas
- Construction of sludge disposal facilities in urban areas and public collective sewerage services in urban areas
- Development of financial models and tariff structure for sludge disposal and sewerage in urban areas.

On the regulation side, **REMA** and **RURA** play strategic roles in sanitation. Notably, RURA as a regulatory agency provides directives on minimum requirements for liquid wastes disposal and treatment. New facilities have to comply with these standards for health and environmental safety. REMA also has the responsibility to issue permit approval, following an environmental impact assessment of any new project. For existing projects, an environmental audit is carried out, following the **Rwanda Bureau of Standards (RBS)** guidelines, which then determines whether a permit is issued or not.

In the context of urbanization, the UPC provides guidance on wastewater management and treatment. In general terms, when planning wastewater management and treatment, the UPC indicates that following shall be respected:

- Treatment facilities shall be located at the lowest point of a human settlement and ideally the watershed, to allow gravity flow
- When establishing a wastewater treatment system, it must be ensured that the pollution of ground water and surface water is prevented
- The quality of effluent shall be audited before being released into the environment, and the tolerance limits published by the responsible agency shall be respected
- Treatment shall achieve at least a 90% reduction of BOD5 to less than 20 mg/l, and for suspended solids to less than 30 mg/l
- There shall be no physical connection between any potable water supply and effluent discharge
- Soil absorption systems for effluent shall not be located in flood prone areas
- There shall be percolation tests performed in the area of discharge to determine the soil absorption rate for effluent
- There shall be no physical connection or cross-connection between any potable water supply and effluent discharge
- Using untreated waste water for irrigation requires crop restrictions as an accompanying measure, and the District shall keep residents fully informed about where wastewater is used for irrigation

5.5.3 Current availability of sanitation in secondary cities

Like the rest of the country, sanitation in secondary cities is managed mostly through on-site facilities (dry pits). None of the cities have sewage or treatment plants, and excreta and wastewater infiltrate into the soil. Public buildings such as hospitals and schools have septic tanks, but disposal methods are not clearly defined. In general wastewater is disposed without any treatment, mostly in pits. Management of sludge is done within undefined local frameworks.

Some cities, such as Nyagatare and Rubavu, are planning to have a centralized water treatment plant but resources have not been allocated yet. In consideration of the SSP on Water and Sanitation 2013/2014-2017/2018, a sanitation master plan has to be prepared and adopted by all of the secondary cities.

Growing urbanization will require an increased quantity of sanitation facilities. For any city, the selection of a sanitation system has to be based on the characteristics of the urban environment.

For example, a city centre with a densely built environment offers an opportunity to implement a heavier technology such as waterborne sewer. The economic rationale for such an investment is stronger due to a lack of space and difficulty in providing a minimum distance between individual facilities. The gain in terms of real estate space is internalized within the investment for sanitation infrastructure.

5.5.4 Green guidelines for sanitation in secondary cities

Sanitation is an essential pillar for urbanization of secondary cities of Rwanda. Lack of sanitation or use of inefficient technologies, can have significant impacts on health risks and the quality of life for inhabitants. Additionally, the most important component of a sanitation system in terms of green growth is not the technologies that are used, but the second-life of human excreta and wastewater. Therefore, the sanitation system can offer benefits throughout its value chain and life cycle, thereby score for strategic planning.

Actions are possible for each component of the sanitation cycle. As such, districts of secondary cities have a strong role to play in the implementation of a sustainable sanitation system that takes into account every step of the process.

The following green guidelines for sanitation should be integrated in the planning and the development process of secondary cities.

Guideline 1: **Plan a system, not only its technological components**

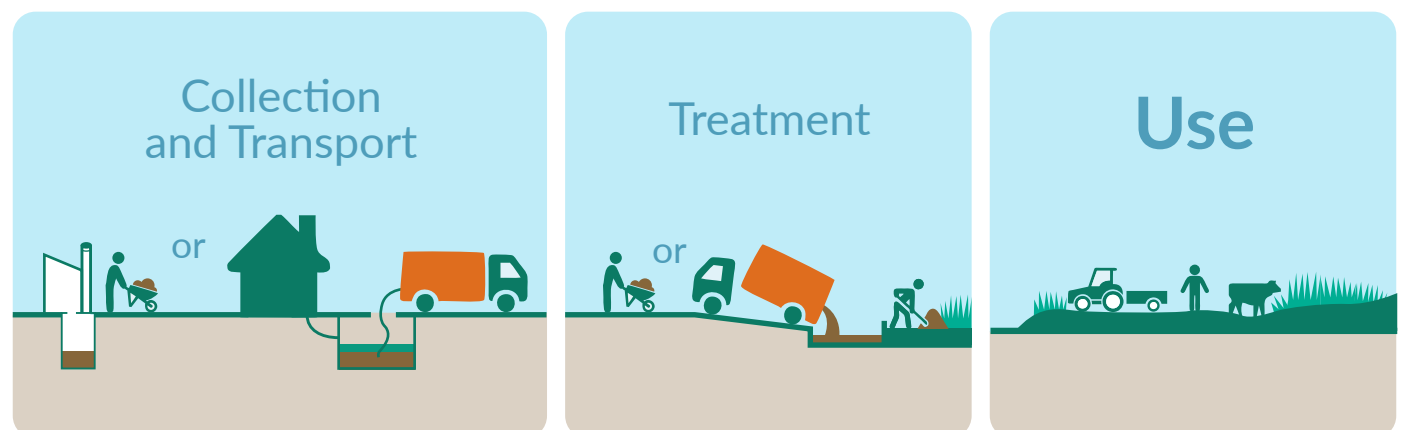
Sanitation should be seen as whole system and not only as a fusion of technologies. Septic tanks, dry pits, and composting toilets, among others, are often referred to as sanitation systems but in fact these are only components of a larger system, which aims at managing efficiently human sludge and wastewater.

During the development of a city with rapid urbanization, it is strategic to have a comprehensive vision for sanitation. The implementation of a system, consisting of the appropriate technologies, should be planned ahead in order maximize the opportunities of reusing outputs generated by human activities.

In a context where most sanitation facilities are individual ones (currently 92.2% of households use waterless latrines or dry pits), it is also important to define in advance a reuse and disposal strategy because monitoring such a large number of facilities can be a challenge for local authorities.

This concept of sustainable sanitation is based on the life cycle of waste, where sludge is generated, collected and transported, treated, and then used productively. Figure 23 on next page illustrates this concept.

FIGURE 23:
SUSTAINABLE SANITATION CYCLE



The first step involves the collection from the source and transport, which requires certain extraction technologies. The second step involves the treatment of the waste, which can take multiple forms where the aim is to separate the nutrients, organics, and the pathogens before further treatment or processing. The treatment technology illustrated in the figure is a planted drying bed. The last step involves the productive use of the treated waste, which can also take multiple forms, where the aim is to recycle the healthy nutrients from the treated waste back into the environment, or to use the treated waste for further green initiatives that contributes to economic growth.

Having a comprehensive strategy for a sanitation system means knowing the travel route of the sludge from the source (households) to the disposal site, which includes sites that process the sludge for reuse for energy production or agriculture.

Failure of sanitation systems in other countries include the failure to plan and implement the whole system, and as a result only implement certain components. For example, no provision is made for the treated effluent and the sludge collected is directly dumped in an open field. A sustainable sanitation system needs to include all of the components (physical parts and actions) required for the adequate management of human waste.

What is important in the definition of a sanitation system is the determination of the final output products and their use. In a sustainable system, the whole cycle is directed towards these final uses. Therefore, it is worth highlighting that the technologies used for collection, transport and treatment must be in-line with the desired final products and their use.

In a sustainable sanitation system, nutrients, biogas, soil-conditioner, and irrigation water recovered from waste and wastewater are used to benefit society in a cycle (e.g. biogas production for cooking gas or electricity; increased soil fertility through added soil-conditioner from sludge drying beds, etc.).

In order to maximize the returns from the system, its planning requires a holistic view and a bottom-up approach. For example, reuse of human waste as a fertilizer for agriculture or for energy production act as additional incentives due to the potential returns, but also add managerial and institutional complexity. Therefore these benefits and costs to society must be weighed up when developing the entire system.

Additionally, during the design process different components have to be identified in conjunction with existing or innovative new technologies, to improve coverage and service while minimizing the negative impact on the environment.

Rapid urbanization such as the one expected in secondary cities, requires a comprehensive planning process. The **SSP for Water and Sanitation 2013/2014-2017/2018** requires the preparation of sanitation master plans for all urban areas and most importantly, the secondary cities.

A sustainable sanitation strategy should highlight priority areas such as the upgrading of sanitation services in specific areas, improvements to the sanitation service delivery chain, and the identification of end-product potential uses.

A sanitation strategy should be an essential part of a secondary city's MPLMUP. Planning forms an integral part of the service delivery cycle in which the outcomes determine the prioritization of improvements and design of projects to meet the identified needs.

Planning should define actions and measures for the short, medium and long-term, and provide a general design of the system, whilst going into specific implementation or operation details, i.e. it defines the 'big picture' for sanitation in a city.

Moreover, planning a city sanitation system is a way to identify stakeholders and attribute key roles and responsibilities for the implementation process.

What are the key steps to develop a sanitation plan?

The following steps, based on the guide “Sanitation 21 – A Planning Framework for Improving City-wide Sanitation Services” (IWA – EAWAG – GIZ), provide a blueprint for a sanitation plan for any secondary city:



1. Build institutional commitment and partnership for planning

Sanitation planning and implementation involve a wide range of actors and institutions. The level of commitment of these actors has a significant impact on the success of the planning process. Therefore, the first step of the planning process consists of establishing the framework and the collective vision for sanitation. The main outcome of this first step should be the formation of a local task force with representatives from all relevant stakeholders, and an agreement on a shared vision for sanitation. Currently in Rwanda, the final choice of sanitation technology belongs to private individuals (the vast majority of sanitation is done through dry pits). Therefore, the population should be represented directly in the task force.



2. Understand the existing context and define priorities

Understanding the specific context of a city is essential. A ‘one-size-fits-all’ sanitation system doesn’t exist, and planning of a system has to be based on a comprehensive analysis of the existing physical and socio-economic context throughout the different areas of a city. All secondary cities already have some forms of sanitation: in most cases through a multiple dry pits located all around the concerned territory.

The current conditions, functionality and efficiency of these facilities have a significant impact on the options for improvement. This step consists of collecting and reviewing information about existing services; identifying constraints to service provision; undertaking a sanitation market assessment (for every step of the cycle: collection to final use or disposal); and identifying priority areas for improvement. The main outcome of this step should be a comprehensive analysis of the current context, including: problems, priority areas for improvement, service expansion, etc. At this step, defining the final destination of outputs is strategic. Specifically, it is necessary to create the opportunity and the market to reuse treated sludge e.g. as fertilizer for agriculture. In the case of weak demand or no market for such fertilizer, other options such as safely burying sludge into pits might be the best option available.



3. Develop systems for sanitation improvement

A sanitation system should be made of the appropriate technologies (see guideline 2). Each area of a city should have the right components based on a good understanding of existing situation, and taking into consideration the specific topographic, social, financial and institutional context identified in the second step of the planning process. Proposed solutions have to provide services for all, including in informal settlement areas. The third step of a sanitation planning process includes a definition of zones for system development, the development of a strategy for treatment, reuse or disposal, and the identification of a collection and transport strategy.

The figure on next page illustrates the implementation of a waterborne sewer network in the central part of a generic city. The end line of this network is a treatment facility that handles the sludge before returning treated water into the river. The discharge point in the river is located downstream of the clean water source (even if the wastewater is treated). The areas that are not served by the sewer network are assumed to be served by a sludge treatment plant. For these

areas, the collection and transport should be managed by vacuum tankers. Transfer stations, either connected or not to the sewer network, are planned over the territory so nobody has to travel in a non-motorized way more than a distance of 0.5km for disposal of sludge. Thereafter, material from stations to treatment is trucked on a regular basis.

The main outcome from the third step of the planning process is a clear definition of the types of systems that are appropriate to serve different parts of the city, with a well-developed plan for collecting, treating and reusing the waste.

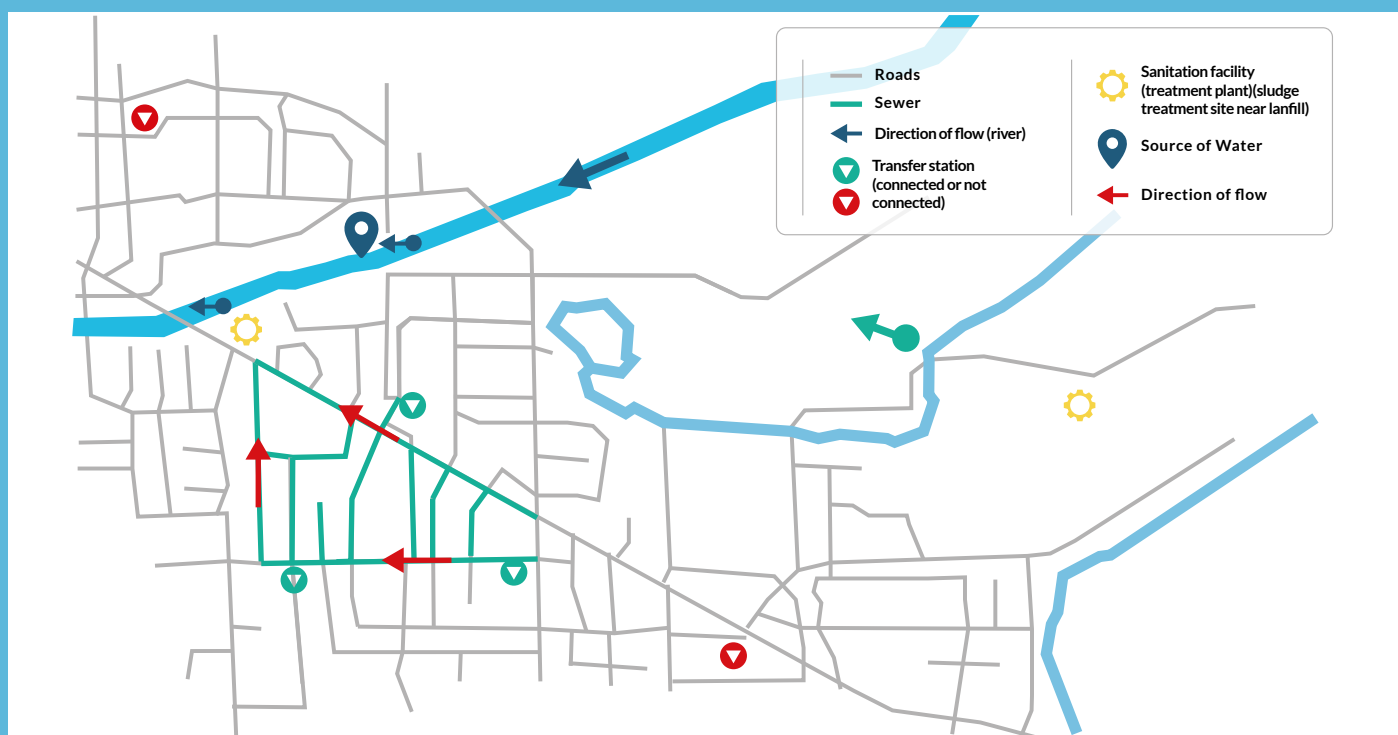
4. Develop models for service delivery

The fourth step of the planning process of a citywide sanitation system is the formulation of the most appropriate management framework for implementing technologies in line with the options defined in step three. The regulatory framework should identify the financing mechanisms put in place in order to fund the services. Definition of delivery models is an outcome of this step.

5. Prepare for implementation

The last step of the planning process consists of putting in place the right framework for insuring coherent implementation. This final step includes a final consultation (in order to ensure that the plan meets the expectations of stakeholders), a sanitation awareness campaign, and capacity building activities with local technicians. The outcome of the fifth step is the final sustainable sanitation strategy itself, and a financing plan.

FIGURE 24:
DEFINITION OF ZONES AND SANITATION FACILITIES





Guideline 2:

Choose the right collection technology based on the context

Large-scale infrastructure such as a waterborne sewer network or a sludge treatment plant requires sizeable investment. However, in the context of a rapidly developing country like Rwanda, sustaining the expansion and development of conventional networks might be a financial and a technical challenge due to various pressures. Moreover, conventional and centralized sanitation systems require advanced technical expertise that takes years to develop.

In the context of rapid urbanization, decentralized technologies appear as the more sustainable alternatives to expensive sewer-based systems. In general in urban areas it has been demonstrated that the investment cost of decentralized sludge management can be five times less costly than conventional sewer-based solution.

Notably, planning the right sanitation solution for the right context could mean implementing multiple technologies in a system-wide comprehensive vision. For example, a central area that is viable for a sewer-based system can be combined with a decentralized strategy for other parts of the city – as mentioned in step three of Guideline 1.

The success of a sanitation system is based on the appropriation of users. As such, community-based planning focusing on the preoccupations of the primary stakeholders of a system and its technologies is essential. Community-based planning means that the community itself holds greater responsibility for the planning process, the implementation process along with managing the outcomes of the process.

In order to comply with the needs of a community, several factors should be taken into account when planning the implementation of sanitation technologies in a new neighbourhood:

The sanitation technology should meet technical abilities of the community in regard to their operation and maintenance – or the district or the central government should provide long-term technical support.

- The system planned and chosen should be viable to build and should provide innovative solutions for the acquisition of capital for construction, functionality and maintenance. Solutions to include potential involvements from the public and private sectors along with development partners
- The system should take into account the level of water supply provided
- Future upgrading should be considered, particularly the connection to a waterborne sewer network
- The system should be appropriate for the soil conditions
- Optimal community involvement during the choice of appropriate system. In addition, the community should be trained to do as much as possible for the construction, running and maintenance of the system.

The UPC identifies three types of wastewater technologies and provides guidance for the implementation of each of them:

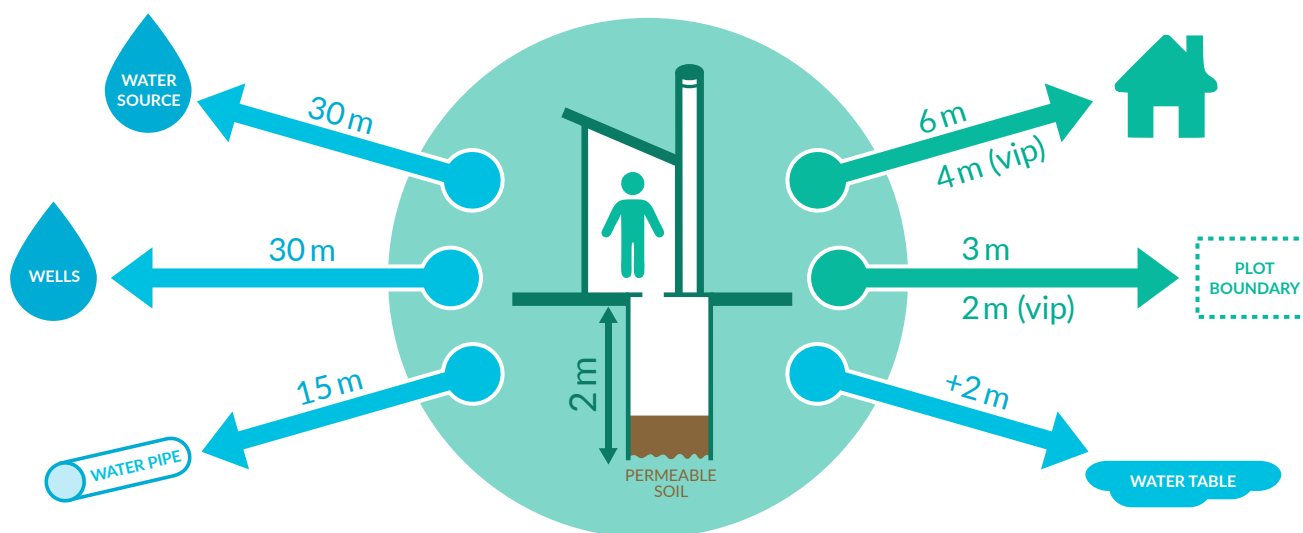
Conventional gravity sewer system: conveying black-water, grey-water and storm water from individual households to a centralized treatment facility.

Simplified Sewerage system: laid in blocks (instead of roads) and in privately used land (instead of public space) in order to reduce the length of sewer, the diameter of pipes, the costs, etc. Simplified sewerage is a suitable sanitation solution when population density is higher than 150 persons per hectare.

Decentralized wastewater collection and treatment: septic tanks, biogas digesters, compost toilets, VIP pits, etc.

Notably, for the implementation of dry pits (the most common system used in urban areas of Rwanda), the UPC provides guidance on minimum implementation standards. Not complying with these standards might have consequences for the environment and pose health-related issues to inhabitants of a neighbourhood.

FIGURE 25:
MINIMAL DISTANCES FOR THE CONSTRUCTION OF A DRY PIT



The development of sanitary systems in secondary cities has to be based on a comprehensive analysis, including cost benefit analysis (CBA), of existing conditions and of available technologies.

In the end, the most important thing is that the entire service chain, including collection, transport, treatment and safe end-use or disposal, is managed adequately.



Guideline 3:

Plan for the treatment and the reuse or disposal of sludge

Reuse of sludge collected from treatment facilities, septic tanks and dry pits (if emptied) is a central component of a sustainable sanitation system. As discussed previously, identifying the potential uses of the end product of sanitation should be part of the planning process of a system. Therefore, considering that roughly over 8% of sludge produced in Rwanda (i.e. sludge that is not managed through dry pit) has to be collected and treated, this waste can be reused if proper infrastructure is available.

Notably, the **Building Code** regulation indicates that the contents of any septic or conservancy tank shall

be removed by an approved excavating truck at such intervals so that a nuisance or hazard is not created. Moreover, RURA's Directives on minimum requirements for liquid waste disposal and treatment provide general standards on how to dispose of waste. This last regulatory document indicates that the treatment of liquid waste is the obligation of all parties that may perform activities that degrade the environment. Notably, article 17 of the directives prohibits the dumping or disposal of any liquid waste in nature prior to treatment.

Treatment of sludge is a strategic step in the reuse of disposed waste process. In a sustainable sanitation strategy, the goal of the treatment stage is to ensure an effective separation of nutrients, organics and pathogens for safe reuse in an open-air environment.

Domestic liquid waste is not usually an extreme environmental hazard unless discharged in a manner where it can impact surface water or shallow groundwater. With proper application, domestic liquid waste can be seen as a resource rather than a pollutant.

Recent technological advances for wastewater treatment, reuse and recovery of water, nutrients and energy resources, have opened up a wider range of options for sludge management.

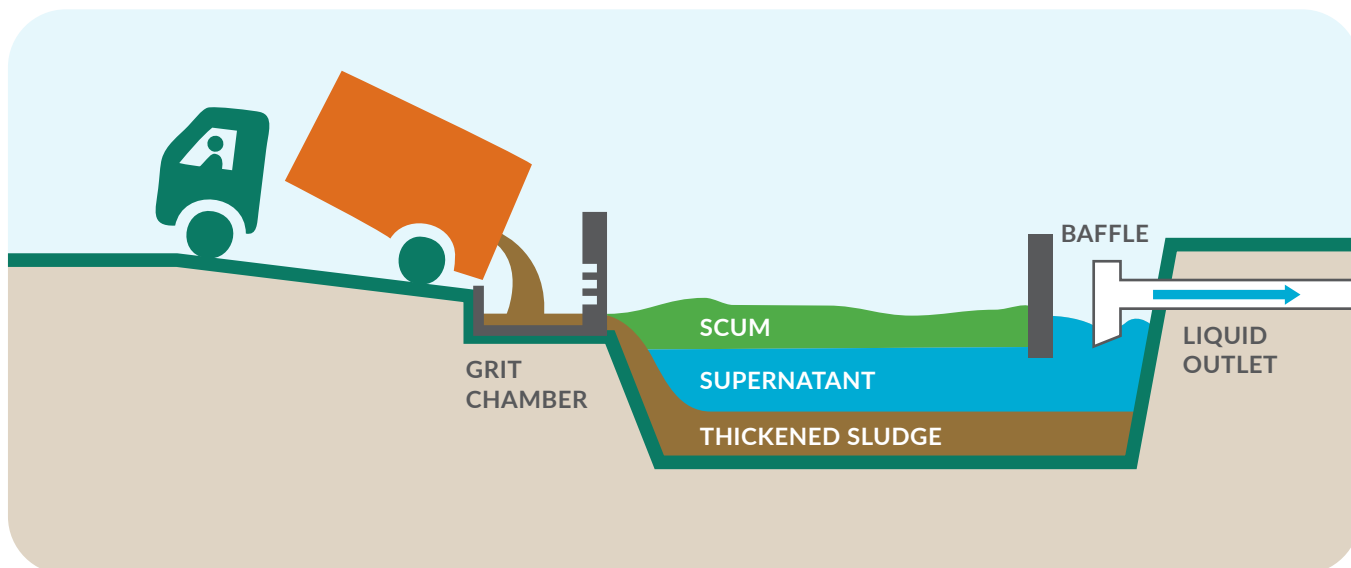
Moreover, the economic viability for reuse in agriculture or for energy production is becoming increasingly attractive due to reduced availability and rising costs of natural resources. With adequate treatment, domestic liquid waste can meet specific needs and purposes, as long as concerns about potential health risks can be overcome.

In the context of Rwanda, five main technologies could be used for the treatment of sludge collected from a centralized sewer system or septic tanks:

Sedimentation / Thickening Ponds

Made of a settling pond that allows sludge to thicken and dewater. The effluent is removed and treated, while the thickened sludge can be further treated by a subsequent technology (dried or further composted). A tertiary filtration might be required for the effluent.

FIGURE 26:
SEDIMENTATION / THICKENING POND

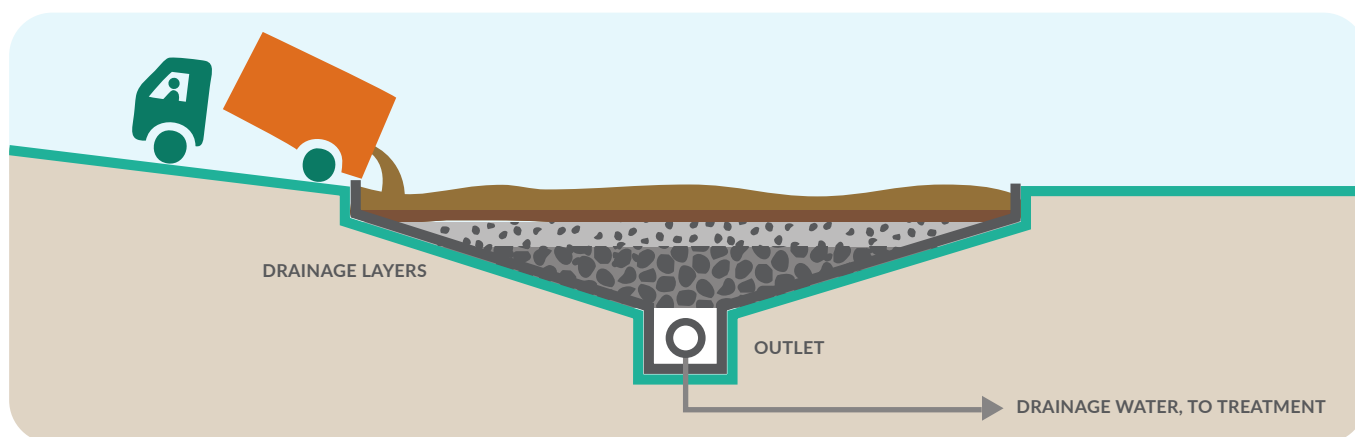


Source: Adapted from EAWAG's Compendium of Sanitation Systems and Technologies

Unplanted Drying Beds

Made from a simple, permeable bed that, when loaded with sludge, collects percolated leachate and allows the sludge to dry by evaporation. Roughly 50% to 80% of the sludge volume drains off as liquid or evaporates. When the sludge is dried, it must be separated from the sand layer and transported for further treatment, end-use, or final disposal.

**FIGURE 27:
UNPLANTED DRYING BED**

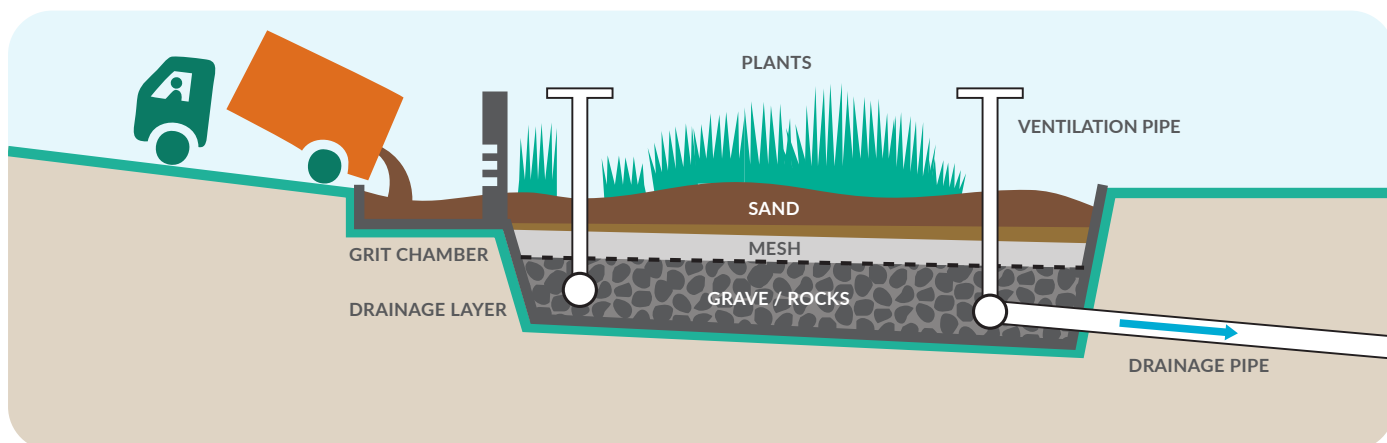


Source: Adapted from EAWAG's Compendium of Sanitation Systems and Technologies

Planted Drying Beds

Similar to an Unplanted Drying Bed, this treatment technology has the added benefit of transpiration and enhanced sludge treatment due to plants. The key improvement of the planted bed over the unplanted bed is that the filters do not need to be de-sludged after each cycle. Fresh sludge can be directly applied onto the previous layer, subject to certain conditions.

**FIGURE 28:
PLANTED DRYING BED**

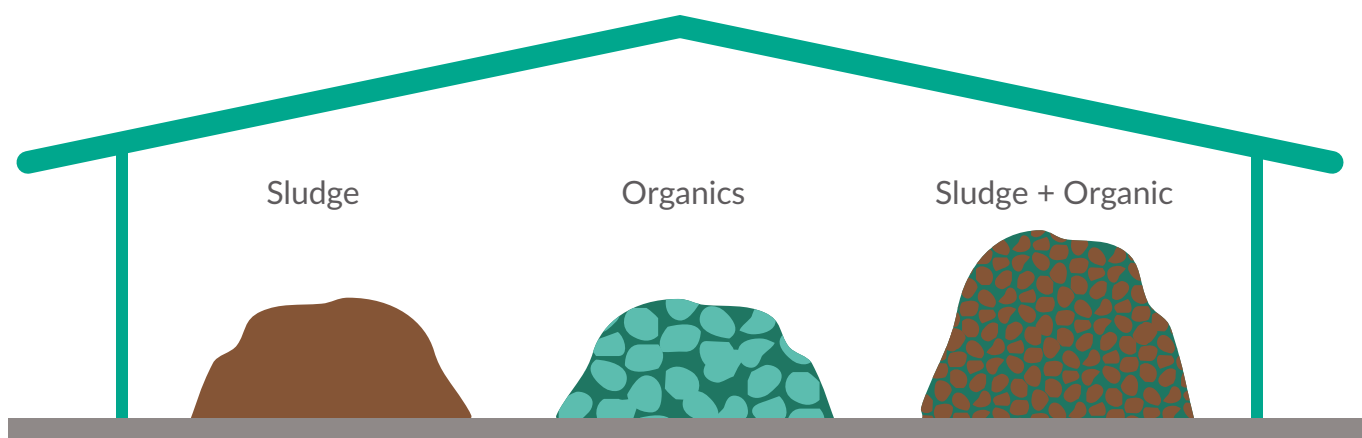


Source: Adapted from EAWAG's Compendium of Sanitation Systems and Technologies

Co-Composting

Co-composting is the controlled aerobic degradation of organic matter, using more than one feedstock, such as faecal sludge and organic solid waste. Considering their respective components, faecal sludge (moisture and nitrogen) and biodegradable solid waste (organic carbon) have good bulking properties. Joining the two, optimizes the end product for reuse.

**FIGURE 29:
CO-COMPOSTING**

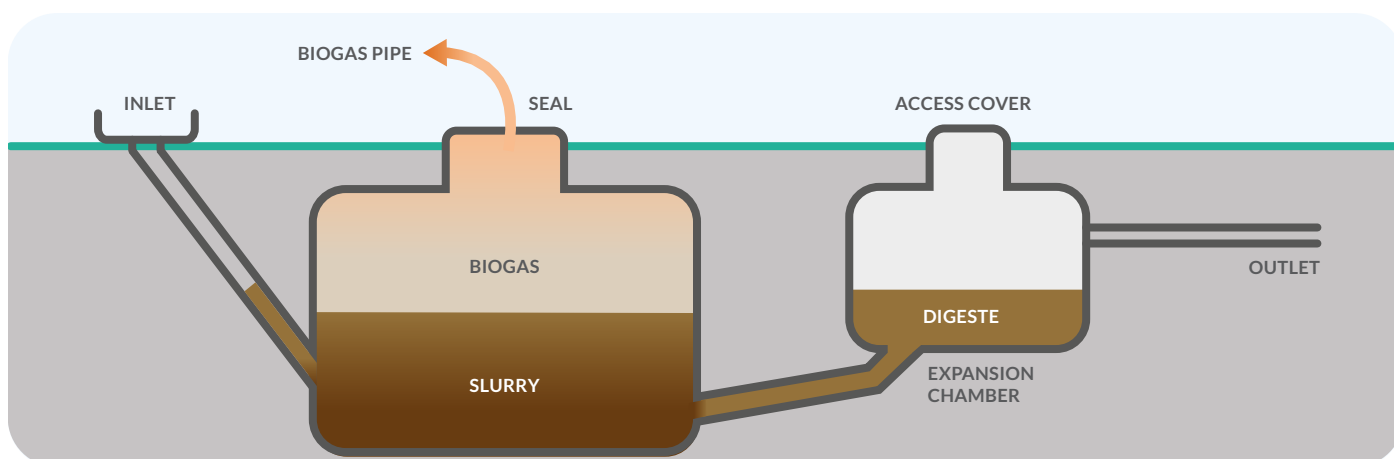


Source: Adapted from EAWAG's Compendium of Sanitation Systems and Technologies

Biogas Reactor

This anaerobic treatment technology produces (i) digested slurry that can be used as a fertilizer and (ii) biogas that can be used for energy. The biogas can be converted to heat, electricity or light. Such a technology is already used in Rwandan prisons.

**FIGURE 30:
BIOGAS REACTOR**



Source: Adapted from EAWAG's Compendium of Sanitation Systems and Technologies

Depending on the treatment method, once stabilized the sludge can be applied to public or private lands for agriculture purposes. Although stabilized sludge has lower nutrient levels than commercial fertilizers, it can replace an important part of nourishment needs. Stabilized sludge originating from a co-composted facility or removed from a planted drying bed, is generally safe and stops generating significant odour or vector problems. However, **it is essential that WHO's guidelines on excreta use in agriculture**⁴¹ are followed. If stabilized sludge cannot be reused, surface or pit disposal should be envisioned.

Several guides such as “**Faecal Sludge Management – Systems Approach for Implementation and Operation**”⁴² and “**Compendium of Sanitation Systems and Technologies**”⁴³ provide technical guidance on the available technologies for safe treatment, reuse or disposal of sludge.

Supported by the City of Kigali, the private company called PIVOT improves the quality and reach of waste treatment services in cities - where they have already established a plant in Kigali City. PIVOT manages human waste in a sustainable way, where its system functions includes:

- **Mechanical Dewatering** – separates the liquid and solids portions of waste
- **Solar Greenhouse** – Use solar radiation, mixing, and ventilation to evaporate moisture in solid material
- **Thermal Dryer** – completes the drying process and fully sanitizes the solid material to create pivot fuel.

The PIVOT fuel is then sold as fuel, a substitute for coal, to the industrial sector. This is what generates revenue to uphold maintenance and operational costs. Its unique business model has attracted participation and support of the CoK.

Cities provide them with constant supply of human waste, which means a constant supply of pivot fuel. In addition, they work with human waste collectors and optimise hygiene of the extraction process to guarantee quality pivot fuel.

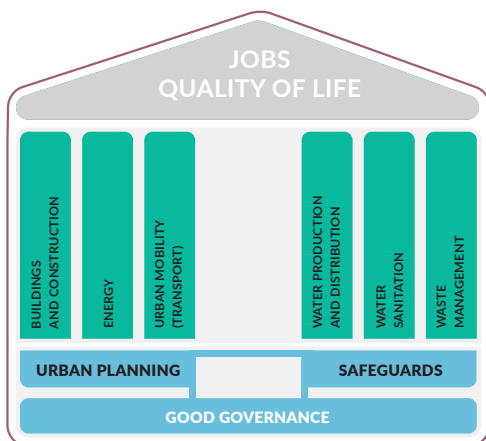
Secondary cities have the opportunity to learn from the success in Kigali City, attract the right support and expertise, and therefore implement. This is a successful example of strategic integration of sanitation objectives and energy objectives to achieve green growth.

41 World Health Organization. Guidelines for the safe use of wastewater, excreta and greywater. Volume 2: Wastewater use in agriculture. Geneva, 2006.

42 IWA Publishing. Faecal Sludge Management – Systems Approach for Implementation and Operation. London, 2014.

43 TILLEY, E., ULRICH, L., LÜTHI, C., REYMOND, Ph. and ZURBRÜGG, C. Compendium of Sanitation Systems and Technologies. 2nd Revised Edition. Swiss Federal Institute of Aquatic Science and Technology (EAWAG). Dübendorf, 2014.





Income levels and urbanization are highly correlated and as disposable incomes and living standards increase, similarly the consumption of goods and services increases - along with the amount of waste generated. Urban residents produce about twice as much waste as their rural counterparts. Therefore, a key aspect to the sustainability of Rwandan cities lies in their capability to manage waste output.

Currently, the waste management system in secondary cities is structured around partial collection, open dumping, partial recovery of recyclables by the informal sector, limited composting, and some landfilling.

5.6 Waste management

As urbanisation increases, waste generation also increases: this could become a serious health issue if not managed correctly and planned according to prospective growth. The waste generation rate is influenced by economic development, available technologies and efficiencies, the level of industrialization and cultural habits.

Solid waste consists of consumption of goods in the economy. It predominantly includes food waste, yard waste, containers and product packaging, and other miscellaneous inorganic waste from residential, commercial, institutional, and industrial sources which can be defined as one of the following classes of waste:

- Biodegradable – food and paper
- Recyclable – glass, metals, and certain plastics
- Inert – construction and demolition waste, soil
- Composite - clothing, packaging, plastics such as toys
- Domestic, hazardous and toxic - e-waste, chemicals, consumer goods

5.6.1 Green growth and waste management

Managing waste flow as part of a sustainable framework is a pillar of green urbanization. A coherent waste management system can reduce the use of non-renewable and renewable resources, create green jobs, and generate money and energy. On the other hand, as an output of urbanization, waste poses direct risks to human health and the environment. The most evident environmental effects of ineffective waste management consists of the aesthetic deterioration of both urban and rural landscapes, and the pollution it could cause to the water, soil, and air.

Waste disposal initiatives can be improved through an understanding of gender differences and inequalities that support women and decrease their work burden through improved family health. The uptake of households participating in recycling and collection programmes is strongly influenced by the gender division of labor, responsibilities and resources, hence an understanding of gender can contribute to programme effectiveness.

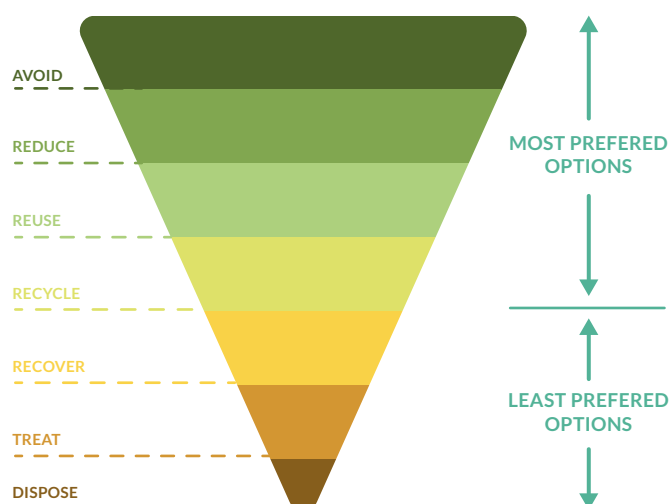
Due to the leachate produced by the decomposition of solid wastes in landfills, pollution of surfaces and groundwater is one of the most prominent impacts of bad waste management on the environment. The pollution of groundwater also requires specific attention since it could be the source of water for the entire population (such as in some secondary cities). If not properly treated, polluted sources may lead to public health impairment and high treatment costs.

The pollution of soils is another impact of badly managed waste flow. If toxic substances are part of the general waste disposed in landfill, they pose a risk to the health of inhabitants and impact of nearby property values. Inadequate waste disposal can cause the deterioration of border urban ecosystems such as agricultural land, recreational areas, and places of interest to tourists, and archaeological sites. The local flora and fauna could also be affected. Landfill sites should be located in places that have little value for the productive sector or for urban development, and they need to have the capacity to accommodate waste without imposing damaging environmental impacts.

Solid waste disposal by landfill also has an impact on air quality. Smoke from burning waste reduces visibility, and dust may contain harmful microorganisms that could cause respiratory infections, and nose and eye irritation. The bad smells are also a serious nuisance factor.

Finally, a bad waste management system also represent health risks for the employees in charge of collecting garbage or managing the landfill. When hazardous waste is mixed with domestic waste, health risks are more acute. As such, education of waste generators (households and industries) and system employees is very important. People sorting waste materials in landfill need specific attention from district authorities in order to improve their living conditions.

**FIGURE 31:
THE GREEN SOLID WASTE MANAGEMENT
HIERARCHY**



Therefore sustainable management of solid waste in secondary cities is crucial. A key to ensuring this, resides in applying the 3R principle: **Reduce at source, Reuse, and Recycle**. Additionally, sustainability with regard to waste management also means using appropriate technologies to achieve acceptable sanitation conditions, and facilitate the recovery and use of materials in the various stage of waste flow. As shown in the figure 30, the **3Rs** occupy the upper tiers of the solid waste management hierarchy that serves as a general guide to the various activities in the waste flow.

Looking at the definition of the 3R principle in detail, the first 'R' concerns the reduction and minimization of solid waste produced. An example in Rwanda would be the already in place restriction of plastic bags, while promoting the use of biodegradable and organic paper bags. The second 'R', concerns the re-using of materials, and implies applying little or no re-processing but being able to re-use these materials again. For example, the re-use of glass drinking bottle falls within this category. The third 'R', recycling, means the processing of used materials for their transformation into new products for use. Commonly, metal, plastic, paper and wood could be recycled. When recycling a product or a material, both the original function and the original form are changed. In addition to the 3R principle, composting is also a green technology, meaning that biodegradable or organic waste is transformed into organic fertilizer.

Energy generation from waste or bio-digestion provides ways to generate a revenue stream from waste. It is estimated that 100 tons per day of raw municipal solid waste can produce 1MW, using traditional thermal technologies. For a city like Kigali, the waste collected is about 1,000 tons per day, which represents an opportunity for a 10 MW energy plant. Moreover, waste-to-power projects are eligible for climate change funds, meaning that additional revenues for emission reductions can be generated by the project.

5.6.2 National context of Rwanda with regard to waste management

In Rwanda systematic waste collection started in 1999, with one company called COPED (**Company for Environment Protection and Development**), which at

that time operated in Kigali alone. Over time, the waste collection system expanded in other areas of the country, and now, waste collection companies and cooperatives are present in most districts.

Currently, the districts of secondary cities provide litterbins for litter storage along streets. Compared with neighboring countries, city centres are comparatively very clean and free from stray solid waste. In general, the cleanliness of streets is a relatively high priority, partly due to the fact that solid waste management has been recognized and made a priority by the highest administrative and political bodies. A good example of this national commitment is the ban on plastic bags, which as an inorganic material is difficult to process.

In general, in rural areas, organic waste is composted and mixed in fields; other types of waste are re-used or buried. In urban areas such as the secondary cities, the districts manage solid waste collection and dispose waste in open dumpsites. In some areas, waste is brought to some cooperatives to sort and recycle the organic waste into compost and briquettes; in other areas, much of organic waste is taken from a collection point and used in generating biogas, significantly reducing the amount of waste in the environment.

In all secondary cities it is prohibited for households to dump waste outside individual private property. Waste collection relies largely on the formal and informal private sector, for both investments and service delivery, and economic market demand determines the level of reuse and recycling of waste.

In recent years solid waste collection has improved but separation of **waste at source is still at a low level and poor solid waste disposal still poses significant health and safety risks**. The general lack of separation at source requires more human resources, energy and money at dumping sites. It also poses health threats to people sorting at dumpsites as they spend many hours in an unhealthy environment with garbage and leachate.

In terms of institutional arrangement, **WASAC** has the mandate to coordinate waste management operations based on the provisions of the law No 87/03 of 16/08/2014. REMA is the agency that develops strategies to ensure proper solid waste management, including dissemination of practical tools on solid waste handling and the promotion of waste recycling companies.

Regulation for waste management are under the authority of RURA, along with the development of standards, maintenance and operation of solid waste disposal sites¹.

The National Policy and Strategy for Water Supply and Sanitation Services provide guidance at the national level for waste management. Notably, one of the objectives of the National Policy is to develop an integrated approach for solid waste management in Rwanda. Such a plan would provide an acceptable framework for understanding and managing waste flows.

With regard to targets, the National Policy indicates that in urban areas the percentage of domestic non-organic waste properly disposed should be of 70%. Additionally, households, public and business entities shall compost up to 70% of its organic waste until 2020.

5.6.3 Current availability of waste management in secondary cities

Every day, tons of waste is brought to the landfill sites located in the surroundings of the secondary cities. Rubavu's landfill is the second largest active landfill in Rwanda after Nduba facility in Kigali, and cooperatives there help by providing some minimal discarding of waste.

In the other secondary cities the landfill sites have minimal management and the gathered waste is just discarded at site and the accumulation of the waste is creating new waste hills in Rwanda. Due to the lack of proper facilities and treatment skills, there are issues such as bad odors, and the emission of the dangerous methane gas, risks of garbage landslides and groundwater pollution.

For example, in Nyagatare the furthest solid waste disposal site is located on the top of a very steep slope on Mirama hill some 5 km from the centre of the city. The site overlooks the town. Bad management is evident due to the disposal of waste scattered around the surrounding site, especially on the route towards the site. In addition, the waste is not covered and the discharged solid waste contains many potential recyclable materials.

¹ RURA, Guidelines on the management of waste disposal site (landfill). Kigali, 2009.

In each secondary city the access road to the dumpsite is in bad condition, which has a direct impact on the efficiency of the waste management system. Deep-seated fires, methane explosions, landslides and leachates threatening rivers and groundwater are common problems that can be observed in such basic dumpsites.

Rapid urbanization, and increases in wealth means the waste generated by secondary cities will become a strategic issue to address for development.

Currently, no facility in the secondary cities has enough capacity to deal with the amount of waste associated with prospective demographic growth.

On a positive note, landfills have been planned in Rusizi and Muhanga from completed feasibility studies. In Rusizi a contract to build a landfill has already been signed between a contractor and RHA. For the remaining secondary cities, studies are still underway.

5.6.4 Prospective needs of secondary cities in terms of waste management

The production of solid waste can be measured in unit values such as kilograms per inhabitant per day. The composition is based on the type of materials forming the waste (organic or non-organic) and the biodegradation characteristics.

The quantity of waste produced by Rwandan households is not clearly defined. However, the analysis of multiple sources provides a general idea of this quantity. First, **UN-Habitat** evaluated in a study² the waste management infrastructure of three Rwandan cities. This analysis focused on Nyanza and Nyagatare, and provided data on the quantity of waste currently generated in Rwanda. For the town of Nyanza waste generation of 19,200 kg per day was observed (0.34 kg/person/day). For Nyagatare, the waste generation per day was estimated at 15,000 kg, which represent 0.29 kg/person/day.

Secondly, based on interviews with OSC staff, **GGGI** estimated that waste generation in Rubavu ranges from

0.2 to 0.5 kg/person/day³. This quantity increases by 25-50% when commercial, institutional, and municipal waste is added to domestic waste. On the other hand, the **State of Environment and Outlook Report 2013** of **REMA**⁴ for the CoK estimated that generation of waste is of 1.8 kg/person/day. This much higher level of waste generated could be explained by the larger size of the industrial sector in the city.

A recent study from the **World Bank**⁵ estimated that the current level of waste generated per capita per day is currently of 0.65 kg for Sub-Saharan Africa. Based on economic and demographic trends, the same study estimated that waste generation will reach 0.85 kg per person per day by 2025.

With regards to the composition of waste in secondary cities, an analysis was done by **GGGI** in the city of Rubavu in 2014. It was found that solid waste is made up of the by-products of domestic, commercial, business, and industrial activities. The waste could be divided into organic waste such as left-over food, leaves and other garden trimmings, paper and cardboard, wood, and other biodegradable material; and inorganic wastes, namely glass, plastic, metals, rubbers, inert material, etc. In Rubavu, the analysis indicated that waste is composed of a high percentage of putrescible organic matter (50-80%), a moderate amount of paper and cardboard (8-18%), plastic and rubber (3-14%), and lastly glass and ceramics (3-8%). According to the same analysis, 85% of solid waste produced in Musanze is biodegradable, and other solid waste accounts for only 15% of all solid waste generated. For Kigali, the waste consisted of 70% organic material.

The composition of solid waste is an important factor to take into account when designing a waste management system, especially when determining the most appropriate recovery options, as well as the treatment and final disposal systems. In Rwanda, recyclable components still represent a small proportion of the waste generated by households.

3 GGGI. Report 2 - Developing Rwandan Secondary Cities as Model Green Cities with Green Economic Opportunities (Appendix). Kigali, 2015.

4 REMA. Kigali - State of Environment and Outlook Report 2013. Kigali, 2013.

5 World Bank. What a waste: A global review of solid waste management. Urban Development Series - Knowledge Papers. Washington D.C., 2012.

2 UN-Habitat. Solid waste management assessment within urban settings in Burundi, Rwanda, and Tanzania. Nairobi, 2012.

In order to estimate, in a preliminary setting, the land requirements for sanitary landfills in secondary cities, it is necessary to establish a general hypothesis. The land requirements identified for secondary cities are **only for the purpose of urban and strategic planning**, and therefore sanitary landfill requirements should be the object of a specific technical study.

Table 18 below shows a preliminary estimate of the needs for each secondary city in terms of landfill area. The current generation of waste in secondary cities is estimated to be 0.5 kg/person/day, and growth in waste generation is 2%⁶. Further details of the calculations made are given in the Appendix of the NR.

It should be noted that this preliminary assessment of needs **doesn't take into account the composition of waste**. For example, if a city is able to divert to composting or recycle half of the waste generated, the needs in terms of space for landfill will be minimized. In the same way, the presence of a waste-to-energy incinerator implies that only the ashes would have to be directed to landfill, which requires less area. The exact quantity of space required for landfill in each secondary city should therefore be defined in the local waste management plans.

**TABLE 18:
VOLUME OF WASTE GENERATED BY SECONDARY CITIES AND AREA REQUIRED FOR LANDFILL**

CITY	HUYE		MUHANGA		NYAGATARE		RUBAVU		MUSANZE		RUSIZI	
	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020	2012	2020
Urban Population	52,768	103,654	50,608	111,901	47,480	181,600	149,209	421,124	102,082	236,638	63,258	137,315
Daily generation 0.5 kg / capita	26,384 kg / day	60,724 kg / day	25,304 kg / day	65,555 kg / day	23,740 kg / day	106,387 kg / day	74,605 kg / day	246,707 kg / day	51,041 kg / day	138,630 kg / day	31,629 kg / day	80,443 kg / day
Total annual generation in tons	9,630 tons	22,164 tons	9,236 tons	23,928 tons	8,665 tons	432,264 tons	27,231 tons	703,270 tons	18,630 tons	50,600 tons	11,545 tons	29,362 tons
Landfill volume m ³ (Accumulated)	23,112 m ³	354,081 m ³	22,166 m ³	286,957 m ³	20,796 m ³	1,037,434 m ³	65,354 m ³	1,687,848 m ³	44,712 m ³	921,623 m ³	27,707 m ³	375,950 m ³
Required landfill area	1Ha	15.3 Ha	0.9 Ha	12.4 Ha	0.9 Ha	44.9 Ha	2.8 Ha	73.1 Ha	1.9 Ha	39.9 Ha	1.2 Ha	16.3 Ha

6 This estimate is generous, considering that waste generation in Rubavu is estimated to be 0.2-0.5kg, and 0.29kg in Nyagatare respectively. The growth in waste generation is estimated at 2%, which might be conservative considering GDP growth rates for the last ten years, along with forecasted growth, and especially for the secondary cities the increase of wealth associated with rapid urbanization. On the other hand household efforts to reduce waste generation at source may also restrict the growth in waste generation. For estimating purpose the coverage of waste collection is estimated at 100% of households - in line with the National Policy target. The volume of stabilized waste in landfill areas is assumed to be 20% cover soil. The total required area for landfills includes 30% of the land set aside for administrative and management purposes (trucking, recycling facilities, sludge management facility, etc.).

5.6.5 Green guidelines for waste management in secondary cities

Modern lifestyles and increasing wealth have resulted in the expansion and acceleration of waste flows. High-tech technologies such as waste incineration are available, but more cost-effective and environmental solutions such as waste reduction and recycling exist, and can have more positive impacts on the sustainability of cities.

New opportunities for greening the waste sector arise as the waste market develops. The two most promising areas are: recycling and the production of energy. Recycling is likely to grow steadily and become a key component of greener waste management systems, while at the same time providing decent employment, green jobs, and opportunities to generate green energy.

In addition, efficient waste segregation and well-organized valorization processes are also key to green growth. The disposal of waste and ashes through well-planned landfills is also crucial for insuring long-term environmental security and safety of neighboring residents and waste management employees.

The government agency, **WASAC**, are responsible for the management of waste flows. It is possible to intervene at each stage in order to accelerate green growth and get closer to the objective of having “zero-waste cities”.

As such, the following green guidelines for waste should be integrated into the planning and development process of secondary cities.

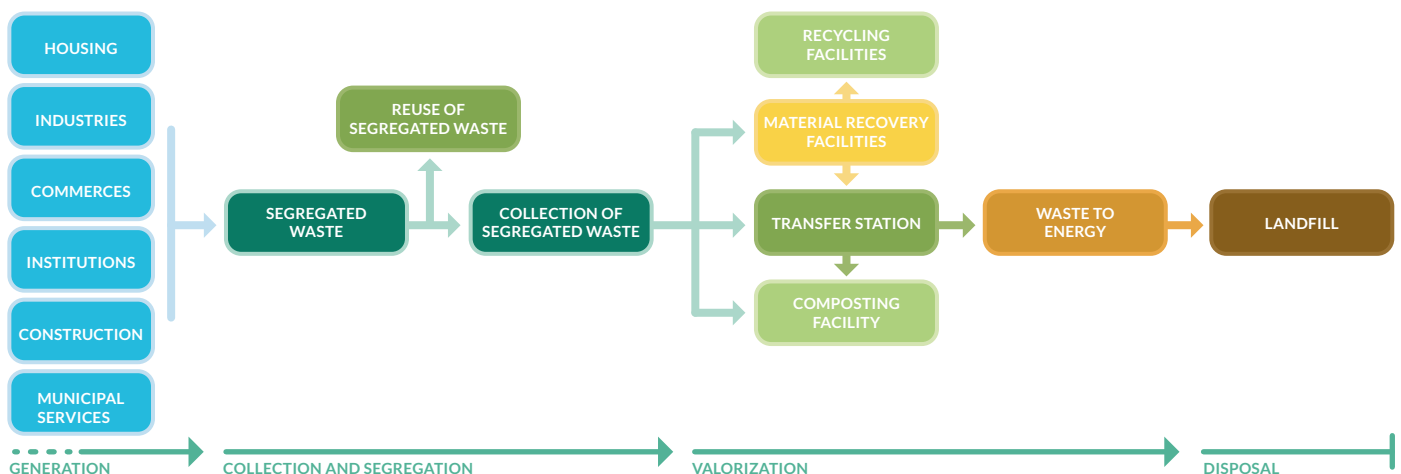
Guideline 1:
Prepare and adopt a waste management plan

Understanding the current waste flow in a city and planning its management is an important step toward green growth.

As discussed previously, in Rwanda, organic materials form a minimum of about 65% of the waste generated by a city. In ideal conditions, this waste material could be valorized and transformed into compost and fertilizers for agricultural purposes. The remaining 35% of waste could be recycled or reused, or might need to be buried in a landfill due to the lack of valorization opportunities. In order to determine a strategy to manage the flow of waste, basic knowledge of what is produced by households and industries is essential.

Figure 32 shows a generic flow of waste in a green city. The first step of the process is the waste generated at source: by households, industries, and other groups. Reducing the waste generated at the start would have a significant impact by reducing pressure on the entire green waste flow.

FIGURE 32:
GENERIC WASTE FLOW IN A GREEN CITY



The second step is the collection and segregation of waste. Efficient waste collection at source from both formal and informal settlements increases sustainability. Segregation provides efficiency gains, but also facilitates material loops through reuse strategies and preliminary low technology recycling. After collection and segregation, the third step is the removal of materials through composting (organic waste) or recycling (non-organic). This step requires storage facilities and markets to be in place for compost and recyclable materials and for the encouragement of community-based waste processing and recycling initiatives. Ideally, materials that can't be recovered should be used to produce energy with an environmentally friendly technology. For ashes or solid material that isn't converted to energy, the final step consists of disposal in a sanitary landfill. The planning of a landfill requires specific technical expertise in order to ensure the environmental long-term safety, well-being of workers, and to ensure quality of life for neighbouring residents.



Guideline 2:

Minimize the generation of waste

Depleting natural resources, together with the environmental impacts of waste and the limited capacity of landfills, has prompted the need for reduced waste generation.

Rwanda is a step ahead of other nations in term of waste reduction. The prohibition of plastic bags has a significant impact on the biodegrading capacity of solid waste in Rwandan landfills. Notably, having minimal waste sequestered in plastic bags accelerates the natural transformation process for organic material.

Encouraging the reduction of waste at all levels of society, plays an important role in diminishing the environmental footprint of a city. Awareness and education campaigns associated with pricing can help to reduce the generation of waste.

A Pay-As-You-Throw charge scheme, where waste management charges correlate with the amount of waste being disposed, constitutes an efficient strategy to link the environmental cost of waste to its real financial price. The

less waste households' disposes of, the less they pay. The implementation of a pricing strategy requires a detailed technical and financial analysis, especially given the low income levels of the majority of Rwandan households. This kind of waste reduction incentive should be targeted at the biggest waste generators such as high-income households and industries.



Guideline 3:

Improve the segregation of waste in middle and high-income areas

In medium and high-income areas the collection of waste is not an issue. The main gain in term of sustainability resides in the implementation of efficient separation practices for organic, recyclable, and non-organic materials.

In some countries such as South Africa, a dual collection system is available in some neighbourhoods in order to facilitate the valorization of waste. A dual collection system is not necessarily more expensive and time consuming.

There are a variety of methods, to achieve separate collection systems, which can be summarized in the following practices:

- Adaptation of existing collection vehicles to collect both recyclables and general waste in a cost effective manner. Existing trucks can be partitioned into two-cabin trucks
- Implementation of a separate collection of recyclables. The contractor receives a separated fee for collecting recyclable material
- Implementation of drop-off and buy-back centres in strategic locations in targeted neighbourhoods, where inhabitants have to deliver their recyclables. This third approach could be less costly and the establishment of such facilities need not be at the cost of the district

What are the key steps to develop a local waste management plan?

In general, a local waste management plan has to be established according to five steps:

1. Analysis of the current situation

This should be based on characterizing the territory; the availability of infrastructure for waste management; the current and prospective demographics; the current and prospective settlement type; the current and prospective socio-economic status of the population; the current services provided for waste management; and the current level of non-collected waste. The analysis of the current situation should include a demographic and economic profile of the secondary city. This profile should include existing and prospective industries.

2. Analysis of the quantity and type of waste generated by the various sources

In order to provide a waste management plan that is in accordance with current and future needs, it is essential to establish a characterization of the quantity and the type (organic and non-organic) of waste generated by the various sources. The characterization of the current situation could be established based on national generic standards (defining the quantity and type of waste per type of household) or could be based on a waste stream analysis at the household and industries level.

The data obtained should determine the current waste generation per capita based on the socio-economic status of household. This daily generation can then be annualized to provide the current yearly generation of waste. Industrial waste located in the city should also be added. Finally, the waste composition should be defined.

This analysis then needs to be prospective, taking into account the socio-economic evolution of households and its impact on the quantity and type of waste generated (greater wealth generally means more waste, and more non-organic waste). Additionally, the economic development of a city will provide guidance on the potential type of industries it wants to attract and are likely to locate there. Based on generic standard it is possible to define a hypothesis on what waste these future industries might produce.

3. Definition of services, infrastructure, and implementation measures

Based on the current and prospective characteristics of waste being generated by a secondary city, the waste management plan should provide targets and implementation measures for each step of the waste flow illustrated previously. As such, collection practices should be defined (management), as well as segregation measures (at source, by collectors, or at waste management stations). Where possible, the waste management plan should provide objectives and implementation measures for recycling, composting and the recovery of waste.

The technical aspects of these facilities should be aligned with the specifics of local waste composition. Finally, the waste management plan should include guidance on the final step of the waste flow: the disposal. The possibility of a waste-to-energy incinerator would define the special needs for a sanitary landfill. The plan should delimit the location and boundaries of the landfill based on national standards and strict environmental criteria.



Nduba Landfill, Waste management facility of the City of Kigali

4. Identification of strategic targets and indicators

Monitoring the evolution of the quantity and composition of waste will provide guidance on the adequacy of the infrastructure and services in place. Additionally, monitoring is a good way to know if targets in terms of waste reduction and valorization (recycling, reusing, composting) are reached – and therefore adjust the public awareness and education policies. Notably, fixing high but sensible targets for recycling and composting will help to minimize the environmental and social impact of waste and increase the sustainability level of the city.

5. Financing and Implementation

An implementation strategy for key services (collection, etc.) and infrastructure (recycling and composting facilities, waste-to-energy plant, and landfill) needs to be defined and financed. The strategy should identify the roles and responsibilities of the public and private sector. Partners of the private sector (cooperative, private contractor, etc.) should be identified as well as public-private partnership opportunities. A financing plan should consider all available sources, including green finance.



Guideline 4: **Improve the collection of waste in low-income areas**

Low-income households generate less waste and the waste generated is mainly composed of organic material. Therefore, segregation at source is less of an issue and the general environmental impact is smaller than medium or high-income households. However, an efficient management approach is still essential for improving living conditions and the sustainability of informal settlements in the secondary cities. The main challenge in the informal settlements is waste collection.

The current context of waste collection in informal settlement of Rwanda is relatively good. For example, in Kigali's informal settlements waste is mostly collected by truck or on-foot workers from collection companies. In general, the collection of waste is done once per week in residential areas and on a daily basis in commercial establishments such as markets, restaurants and bars.

The Urban Planning Code stipulates that a waste disposal facility should be at a maximum distance of 250 meters of any household. In medium and high income households compliance with this provision of UPC is not an issue as door-to-door collection is available.

However, in some informal settlements compliance could become a challenge due to poor access or a lack of financial resource. With regard to waste collection, the main challenge resides in the informal settlements.

Payment compliance among the residents for the service offered is not a prominent problem, with charges of Rwf 500-2,000 made on a monthly basis. Challenges exist in some informal settlements due to a lack of access to housing units: road infrastructure can be limited and the collection vehicles cannot reach all the households. Where road infrastructure does exist, streets are often inaccessible for conventional waste collection vehicles due to steep slopes, narrow roads, sharp curves, and deep pot-holes. Also, some households have limited capacity or are unwilling to pay for collection services. Therefore, illegal dumping is observed close to footpaths, water channels, and drainage infrastructure.

In order to minimize the illegal disposition of waste due to bad access or limited financial capacity, collection strategies could be implemented.



Guideline 5: **Maximize the valorization of waste through composting, recycling and reusing**

Valorization of waste includes composting of organic material, and the recycling and reusing of non-organic materials such as plastic, paper, glass and metal. Development of green cities requires that recycling and composting form an important part of the local waste management plan.

Valorizing organic and non-organic material has a direct impact on the space required for landfilling and the need for an incinerator where land is limited, such as in Rwanda. To reach such an ambitious state, requires the construction of efficient recycling and composting facilities and the development of a market for valorized materials.

Composting is the process of decomposition of organic waste by the bacteriological action of microorganisms contained in waste itself. The end-product of this process is known as 'compost' or 'organic fertilizer', a product similar to humus, that acts as a soil conditioner, rather than a non-organic fertilizer, and has added commercial value. Recycling, as explained at the start of this chapter is a process by which solid waste is used as raw materials for an industrial process to manufacture new products and materials of the same composition.

After the removal of all useable items from the solid waste, the remaining waste must be disposed of, through incineration or landfill. Incineration has the advantage of converting waste into inert material – such as cinder and ashes – and reduces the waste to up to 10% of its original volume. The heat generated can be used for **electricity generation**.

Waste-to-energy constitutes a good strategy to maximize the positive externalities of waste, but it adds a layer of complexity and is associated with higher costs.

Furthermore, incinerators pose a disposal concern due to 'fly-ash', which contains various toxic elements and can have health implication.

Recently, several waste-to-energy projects were implemented in other Sub-Saharan Africa countries. Ethiopia constructed a 50 MW waste-to-energy plant in Addis Ababa through a public-private partnership between the local power corporation and a waste-to-energy developer. At an estimated cost of \$120M, the plant was the first waste-to-energy facility in Sub-Saharan Africa.



Guideline 6:

Design green and efficient sanitary landfills

The biggest challenge associated with the final disposal of solid waste is to ensure that a sanitary landfill is operated efficiently and in compliance with strict security guidelines. Landfills have the advantage of being low cost, but cause environmental issues if not correctly managed, particularly in terms of vermin, leachate and the consequent rise of health problems for neighbors.

Considering the current state of waste management in secondary cities, new sanitary landfills will be required. These new landfills should be accessible, but located outside of the built area.

RURA, the regulatory agency of Rwanda has established minimal guidelines for the planning and the operation of a sanitary landfill. In accordance with the law, no city or district (or private operator) shall develop or operate a waste management facility without the consent of the agency.

RURA's guidelines stipulate that a landfill shall meet the following minimum standards:

- The bottom of the landfill shall be at least 3 meters above the seasonal high ground water level
- The maximum height of the site above ground level must not exceed three meters
- The slope of the sides of the site must be constructed in such a manner that little or no erosion occurs
- The edge of the landfill shall not be closer than 60

meters to a surface water body and 100 meters upstream from a public water supply well

- The landfill shall not be located in aquifer recharge areas or public water supply catchment areas unless there are no other feasible alternatives.

Moreover, based on **RURA standards**, the location of a new landfill shall meet the following criteria:

- The site shall not be within 3 km of an airport, airfield or site reserved for the construction of an airport or airfield
- The site shall be located and operated in such a manner that it does not create significant negative impacts on flora and fauna in adjoining land
- The site shall not be within 400 meters of an existing residential development
- The edge of the landfill shall not be within 100 meters of an area which has public access, a national park, protected area or an area having national historical or archaeological significance
- There must be a buffer area around the landfill of at least 20 meters to allow provision for visual screening from adjoining properties

In addition to current standards, the planning of a new landfill should include the following parameters:

- Sufficient land should be reserved for internal roads, and management facilities
- The internal road grid should be aligned with the water supply, basic drainage and power supply
- The access road to the site should contribute to the efficiency of the waste management framework (such as no pot-holes)



6. Pull factors of urbanization

As previously discussed (chapter 3), urbanization of the six secondary cities is a challenge considering the targets set by the GoR (35% of the population to be urbanized by 2020), and the current needs of these cities in terms of urban planning, infrastructure development and job-creation opportunities.

The two main factors driving migration from rural areas to cities in Rwanda are economic opportunities through jobs and the access to a better quality of life through the provision of efficient public services. By definition, cities offer both an abundant and diverse array of job opportunities as well as higher average pay than rural areas. Therefore, access to better wages is generally considered as a prime driving force behind the urban migration phenomenon. Moreover, access to better schools, improved security and basic health services are also factors that explain the phenomenon of urbanization.

A government has the capacity to act pro-actively on the urbanization pull factors in order to accelerate urbanization itself. Therefore, the GoR can undertake direct action on the two main factors explaining the urban migration phenomenon: economic opportunities and provision of public services.

Accelerating job creation in secondary cities will improve the attractiveness of the city in Rwanda, a country where urban life is a relatively new reality. Moreover, job creation is an important component to a green growth strategy. Employment associated with green infrastructure development and, in turn, its functionality, consists of green jobs that will contribute to the transformation of the Rwanda's economy, as per one of the EDPRS 2 objectives – Pursue a 'green economy' approach to economic transformation.

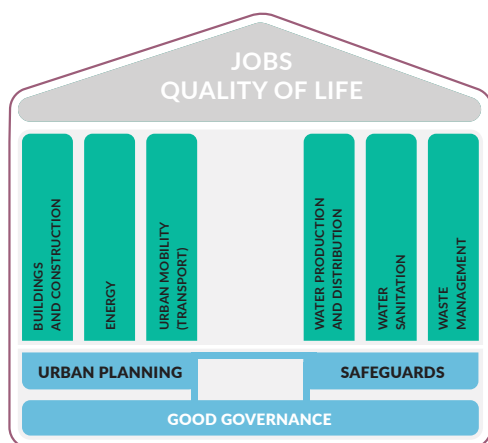
In addition, accelerating the development of basic services (such as education and health) in secondary cities will improve the quality of life in urban areas and will contribute to the 'pull-factors' of urbanization into the secondary cities of Rwanda. Based on the 'agglomeration effect' cities tend to offer more educational and health facilities than their rural counterparts.

Moreover, for the government, a higher density of population can facilitate the provision of public services to more people per square kilometer of land. However, the acquisition of capital to facilitate this development, whether it be in the form of expertise or technologies, is still lacking, and with the forecasted population growth, this will become a more prominent issue.

Overall, in order to mitigate the negative effects of urbanization and embrace the benefits that green initiatives can bring in order to accelerate the urban migration phenomenon, the GoR has to be proactive in job creation and the delivery of efficient public services in secondary cities. As such, the targets of EDPRS 2 will be reached and the increased concentration of population in the secondary cities will contribute to sustainable economic development. Improving equality in attitudes to work for women will enhance the productivity of the work force.

The **National Gender Policy** aims to significantly reduce the number of women involved in the care economy through training and facilitating access to credit. The GoR will also run a campaign to improve women's position in the labor market and to change attitudes towards the kind of jobs that men and women can do.





6.1 Economic growth and job creation

Job creation and economic development are strategic pull factors for urban growth for the secondary cities.

The foundations of urbanization — good governance, urban planning and safeguards — and the pillars of urbanization — building and construction, energy, urban mobility, water production and distribution, water, sanitation, and waste management - are essential to enable the developments of the sustainable infrastructure needed for green urbanization. However, this only satisfies a few characteristics of achieving green growth within a city.

Inhabitants are the central element of the ‘wealth creation machine’ in a city. In Rwanda, secondary cities need to be ready and have pull-factors to attract dwellers to fuel the wealth creation machine to, in turn, meet national targets of urbanization. What attracts a person to moving into a city?

As per previously outlined, the main drivers of rural to urban migration in Rwanda are job opportunities and the access to efficient public services. Job creation increases economic opportunities for the dweller in various ways, such as pursuing a desired career path and acquiring higher paid jobs. The city itself also experiences increases in economic opportunities through increased economic productivity which, in turn, triggers economic growth. Thereby an essential ingredient to economic growth in a city is having a job market characterized by growing opportunity.

Moreover, certain measures can be taken to make sure this growth is green growth: where it is inclusive, protects and preserves the environment, and is sustainable to overall achieve the overall national development priorities of poverty alleviation.

6.1.1 Green growth, local economic development, and green jobs

Green growth is economic growth that is compatible with the protection of the environment, reduction of greenhouse gas emissions, improvement of the rational use of natural resources, building climate resiliency, security of access to clean energy and water, and simultaneously targets poverty reduction, job creation and social inclusion. Considering the production value chain of goods and services in society, there are various channels in which green growth objectives can be integrated. Economic development of both the foundations and pillars of urbanization, greening the infrastructure sector, to achieve green urbanization covers a large proportion of the production value chain of an economy. It is therefore critical that a developing country at its early stages of industrialization and urbanization to take sound decisions in order to grow on a green path. Therefore, promoting the development of a green economy is a necessity for green growth.⁷

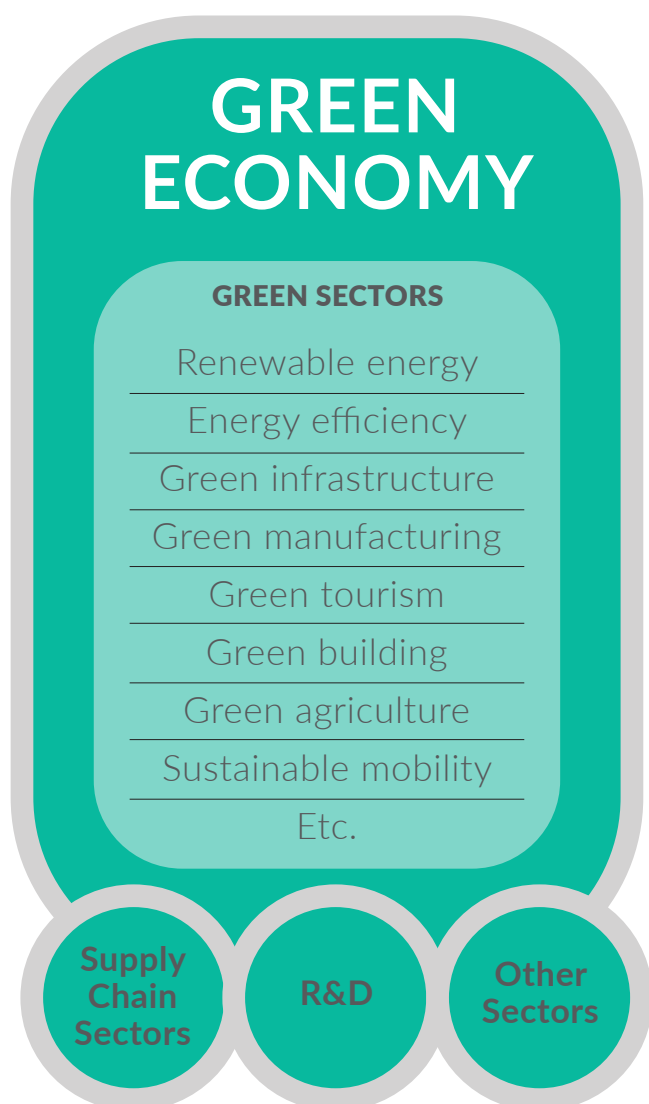
The green economy designates a set of activities associated with research, technologies and industries, which are directly geared to improve environmental outcomes, reduce pollution, preserve energy and protect natural resources. Their inputs into other sectors enable them to reduce their carbon intensity and enhance environmental outcomes.

This includes industries and technologies explicitly aimed at reducing carbon but also includes broader environmental industries such as sewage treatment, environmental protection, soil management, biodiversity protection and wildlife management, and noise and vibration protection.

Figure 33 illustrates that some sectors constitute as the 'core' of a green economy (such as renewable energy, green infrastructure and sustainable mobility).

As the green economy expands and as the regulations and policies become more restrictive, the whole economy will eventually have 'shades of green' in non-core sectors such as traditional manufacturing, R&D, supply chain and logistics.

**FIGURE 33:
THE GREEN ECONOMY**



Source: Adapted from Miranda, G., et al. (2011a), "Climate Change, Employment and Local Development in Extremadura, Spain", OECD Local Economic and Employment Development (LEED) Working Papers, No. 2011/04, OECD Publishing.

In the context of Rwanda, promoting the development of a green economy is rather an opportunity than an obstacle when it comes to creating jobs in the private and the public sectors. Greening the economy can be recognized as a chance for creating jobs, which will become engines for sustainable economic growth. Thereby, increasing supply and demand for green goods and services can be met whilst alleviating poverty.

Green jobs are jobs provided by businesses that recognize environmental protection or preservation as a driver of global and national economic development. A job can be considered green when it contributes to environmental improvement more than an equivalent business-as-usual job.

Whether it is in the sectors of agriculture, industry, services or administration, green jobs can be linked to a wider spectrum of sectors which include the acquisition of a wide array of skills. This can be within the educational system (theory and practice of greening the economy), law and regulatory administration, and from all areas of production value-chain of green goods or services.

The creation of jobs from the green guidelines presented in this National Roadmap, such as from green buildings or sustainable mobility, could overall be seen as a green-job initiatives due to its positive effects to the environment. These green goods and services are not always green throughout the value chain, from its production processes and technologies to its consumption.

This therefore increases the variety of green jobs opportunities and thus sustainability of further environmentally friendly processes.

In general, the following sectors are considered as 'core' of the **green economy**:

Renewable energies

An energy source from renewables is an area of expertise directly classified as a green job. Jobs in the renewable energy sector are diverse, ranging from production and installation of solar panels or wind turbines, through the operation of hydroelectric plants. However, although the development of renewable energy source into the main grid represents a strong

demand for labor, the number of jobs in the long term is often marginal⁸.

Green infrastructure

The concept of green infrastructure includes all man-made infrastructure that preserves or increases the productivity of natural resources, or infrastructure that are developed considering environmental safeguards. The development of infrastructure generates a significant quantity of high-skilled and low-skilled jobs and has a direct impact on the national economy.

In the context of greening the secondary cities, the development of green infrastructure for energy, buildings, waste management, sanitation, water production and sustainable mobility can become significant in regard to providing jobs and in accelerating the attraction of new investments in Rwanda. With the current high need for infrastructure for urban growth, it presents with an opportunity to increase the demand for high-skilled and low-skilled workers with higher levels of job security under a continuous approach to sustainability.

Green manufacturing

Consumer demand, regulation and trade liberalization has directly affected businesses in the manufacturing sector during the last decade. In addition, this entailed many adjustments, where in terms of jobs, were consequential to climate change regulation. Stricter regulations meant a transformation of the job profiles and the skills required for the production of low-carbon manufacturing goods. Therefore manufacturing is an important source of job creation in the green economy. A government could have a direct impact on this sector by promoting the development of manufacturing clusters that are part of the green economy.

Green building

Building design and construction is one of the most labor-intensive sectors of the economy. It provides jobs for skilled technical workers (architects, engineers, designers, plumbers, electricians) and for day laborers. Green buildings comply

with standards in terms of energy efficiency, materials, and construction process.

Green tourism

The tourism sector is labor intensive and one of the main source of income in Rwanda⁹. At the global level, this economic sector is under transformation, where there is extensive action in setting new certifications and creating environmental labels to attract the consumers and investors searching for these kind of services.

The green tourism industry is committed to good environmental practice and aims to reduce the environmental impact of all its business activities. Moreover, green tourism offers experiences that are respectful of the plant life and wildlife, and serves as a means to educate and promote the protection and preservation of the environment. With its rich level of natural features, Rwanda is already succeeding and benefiting from tourism, but has further potential to develop its green tourism industry, notably near the cities of Rubavu, Musanze and Rusizi.

Green agriculture

The agriculture sector has much potential for job creation to significantly contribute to in the development of a green economy. As the population grows, the demand for food increases. The agriculture sector has to therefore increase supply to meet the increasing demand. This enables the sector to deploy green technologies and follow more sustainable practices, therefore requiring expertise and man power for its development and functionality.

6.1.2 National context of Rwanda with regard to local economic development

Rwanda's current population size stands at approximately 12 million, where 74% of the population, which is above 16 years of age, is active and 71% is employed. The unemployment rate in urban areas is on average 7.7%, which is double the rate from the national level (3.4 %).

8 OECD. Enabling Local Green Growth - Addressing Climate Change Effects on Employment. Paris, 2012.

9 Ministry of Trade and Industry - Government of Rwanda. National Industrial Policy. Kigali, 2011.

Currently, the private sector employs over 90% of Rwanda's workforce. Small and medium-sized enterprises (SMEs) account for 98% of the estimated 123,000 businesses operating in the country and they provide 84% of total private sector employment. Unemployment rate among active youth (between 16 and 35 years old) is 4% in urban areas and 8.7% at the national level. An overview of the unemployment rate shows that young people with a secondary school or a university degree are the ones most affected by unemployment (13%).

This situation highlights the need to accelerate job creation, especially for young people and women in order to sustain inclusive growth. Improving equality in attitudes to work for women will enhance the productivity of the work force. The **National Gender Policy** aims to significantly reduce the number of women involved in the care economy through training and facilitating access to credit.

Vision 2020 aims for rapid economic growth, GDP growth of 11.5% per annum, and increasing the GDP per capita to \$1,240 by 2020 (from \$638 USD in 2013). It also focuses on increasing growth in all sectors, and shifting the economy towards an increase in GDP from industry and services. **Vision 2020** also aims to close the trade balance by increasing exports to 28% per annum and maintaining the current import growth rate at 17% per annum. The **EDPRS 2**, the medium term strategy, has been established with the aim of ensuring a better quality of life for all Rwandans through achieving a reduction of poverty to less than 30% of the population.

In order to reach the mentioned targets, the GoR has developed the **National Industrial Policy (NIP)**, the **Decentralization Implementation Plan (DIP)**, and the **Common Development Fund**. Local economic development (LED) is a strategic component of the DIP and is focused on supporting local governments to effectively develop their economies.

Rwanda's National Industrial Policy (NIP) sets a framework for diversifying Rwanda's industrial base at the country-level. The main goal of the NIP is to build local production for local consumption and export markets. In the short term, government assistance is envisioned to improve the feasibility of existing industries (such as coffee and tea) and sectors that have been deemed feasible (such as agro-processing). The medium term goal is to

promote new sectors as they become feasible and the long-term goal to reduce support to successful sectors, shifting support to new sectors. A number of clusters have been identified in the NIP:

- **Short term:**
Agro-processing; ICT; high-end tourism; textiles; minerals processing. These sectors are currently active to varying degrees.
- **Medium term:**
Construction materials; Pharmaceuticals; chemical products. These sectors are mostly inactive.
- **Long term:**
Building materials; bio plastics; other high-tech industries. These sectors will require a larger industrial base to become feasible.

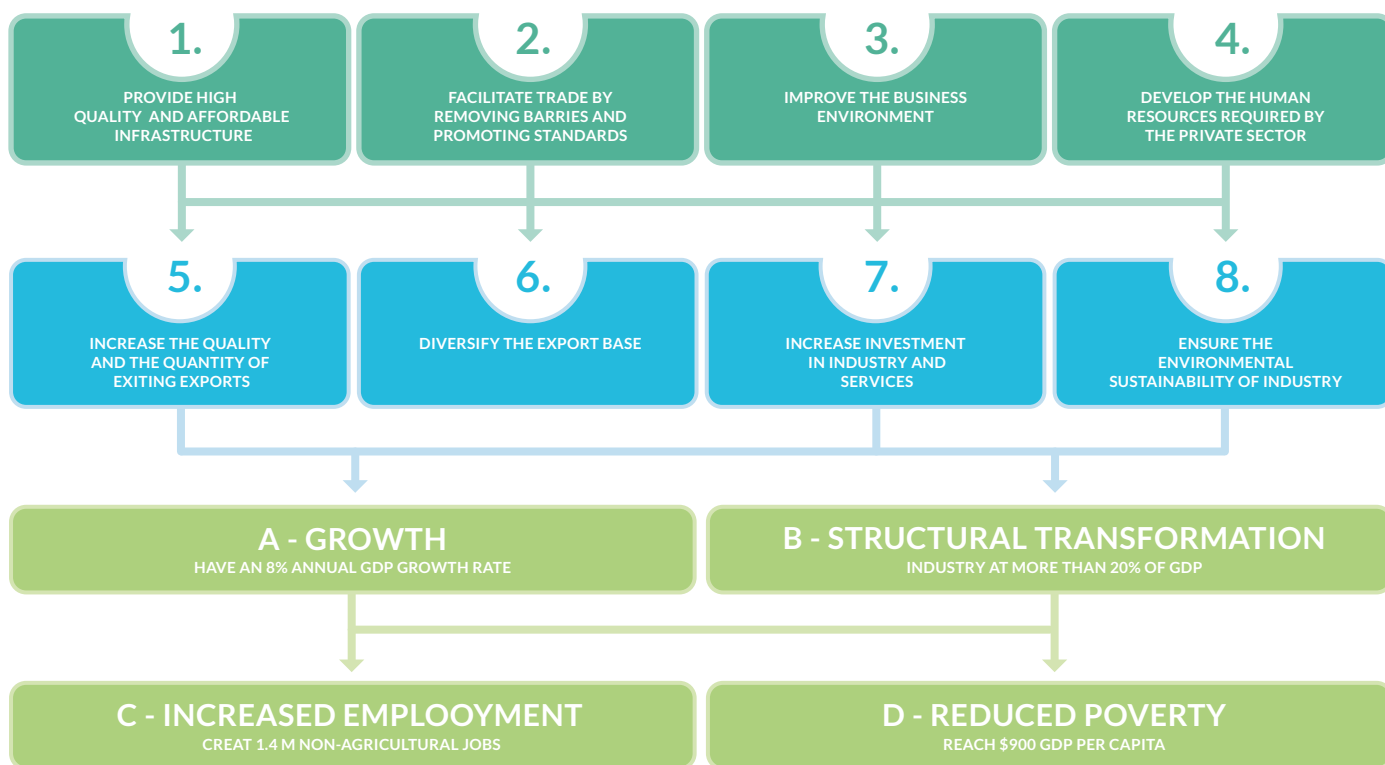
In order to accelerate the development of the industrial base of Rwanda, the NIP sets out eight clusters of actions. These clusters are illustrated in figure 34 and aim to: accelerate GDP growth, transform the industrial structure of the country, increase the employment in non-farm sectors, and decrease poverty.

The development of secondary cities can contribute to the diversification of the industrial base of Rwanda and its economic growth.

The action plan of the NIP provides the roadmap for economic development of Rwanda. In addition to the industrial sectors prioritized by the NIP, the **National Export Strategy (NES)** has outlined the export products that offer the greatest opportunities. Also, for the facilitation of investment, a **Special Economic Zone (SEZ)** was established in Kigali and four industrial parks are in development in the districts of Bugesera, Huye, Nyabihu and Rusizi.

The NIP suggests that **investment in urban infrastructure is critical** and has a direct impact on industrialization. The priority given by the NIP to infrastructure is directly aligned with secondary cities' development and offers a strategic opportunity to create jobs.

FIGURE 34:
ACTION PLAN OF THE NATIONAL INDUSTRIAL POLICY OF RWANDA



Good infrastructure is strategic for the development of cities. As previously shown, investing on the pillars of urbanization will contribute to sustainable growth; it will help mitigate the negative impacts associated with city development; and it will contribute to accelerating urbanization.

Infrastructure is central to development and economic growth. It directly affects the production process of different sectors, and indirectly affects productivity and efficiency of the consumption of the goods and services produced, and long term health. In addition, the total factor of productivity rises from the combined effects.¹⁰

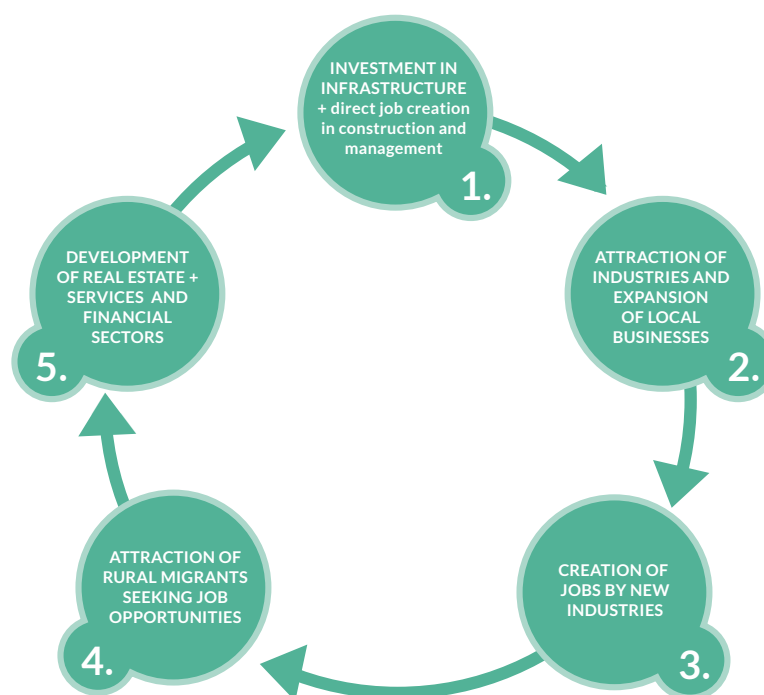
As illustrated in figure 35 on next page, investing in infrastructure contributes to a cyclical multiplier effect that accelerates urban development.

10 AGHION, Philippe. BESLEY, Tim. BROWNE, John. CASELLI, Francesco. LAMBERT, Richard. LOMAX, Rachel. PISSARIDES, Chris. STERN, Nick. VAN REENEN, John. Investing for prosperity: skills, infrastructure and innovation. LSE Growth Commission Report. London, 2013.

The first stage of this cyclical infrastructure development:

1. Investment in infrastructure provides direct jobs at the development stage (such as construction of roads, sanitation, and water and waste facilities), but also at the management stage (such as fee collection on buses and maintenance of roads).
2. Good infrastructure helps to attract job-creating industries and sustain the expansion of local businesses.
3. New industries need human capital and therefore jobs are created for skilled and low-skilled workers.
4. New job opportunities attract migrants from rural areas and decrease the existing over-concentration of opportunities in Kigali.
5. New urban dwellers need houses, food and goods, which accelerate the development of real estate, and service and financial sectors.
6. More infrastructure is required to sustain a larger population and a wider economic base.

**FIGURE 35:
INFRASTRUCTURE AND JOB CREATION CYCLE**



6.1.3 Prospective needs of secondary cities in terms of jobs

In the context of the EDPRS 2, Rwanda has a target to generate 200,000 jobs annually in the service and industrial sectors, mostly in urban areas. For this target to be met, a number of measures in the job market and the education system must be enforced especially for Technical Vocational Education and Training (TVET), since a productive labor force is essential to develop the economy and increase industrial performance.

The current situation in terms of employment varies for each district. Table 19 below shows the employment rate of each district and the distribution of jobs in the public, parastatal and private sectors – formal and informal. It is important to highlight the importance of the **informal sector** in all districts as it constitutes the majority of current employment.

**TABLE 19:
EMPLOYMENT RATE AND DISTRIBUTION OF JOBS SECTORS AMONG DISTRICTS**

DISTRICT	EMPLOYMENT RATE	PUBLIC	PARASTATAL	PRIVATE (FORMAL)	PRIVATE (INORMAL)	OTHER
Huye	80.2%	11.9%	4.7%	15.8%	64.8%	2.9%
Muhanga	86.4%	8.7%	2.3%	17.4%	71.9%	0%
Nyagatare	84.8%	6.5%	3.7%	8.3%	81%	0.5%
Rubavu	79.6%	9.1%	3.4%	16.2%	69.5%	1.7%
Musanze	84.7%	10.7%	1%	10.7%	76.6%	0.9%
Rusizi	77.9%	9.7%	2.7%	20.9%	64.3%	2.4%
Rwanda	84.2%	9.1%	3.4%	16.2%	69.5%	1.7%

Source: EICV3, NISR, 2011

The informal sector is made of a wide range of economic activities (retail, street trade, moto-taxis, craft, etc.). The informal sector is strategic and tends to be beneficial to rural migrants who settle in the city. However, an excess of these activities can have a negative impact on the development of the formal sector. Even if the formal and the informal sectors continue to coexist, a gradual transition toward a regulated and formal economy is essential.

The working age population of Rwanda (between 16 and 64 years old) is projected to be 7,2M in 2020. Considering a projected urbanization rate of 35% this means the urban working age population will be of 5,040,000 people in 2020. If we assume an employment rate of 70% this means that 3,528,000 urban jobs will be needed. As secondary cities represent 24% of all jobs in 2014 (846,720). Currently (2014), there are about 40,000 urban workers in secondary cities. Consequently, 816,720 jobs have to be created by 2020, which represent 163,444 jobs per year for the next five years or 27,224 jobs per secondary city per year.

Considering the anticipated increase in population growth, job creation in secondary cities is essential and should be strategic. Moreover, the availability of jobs is a pull factor for the secondary cities, therefore there is a need for direct key actions from GoR and districts. Based on the document '**District potentialities assessment for the integrated and self-centered local economic development**'¹¹ each secondary city offers key development opportunities from their unique potentialities. These potentialities should be the basis for local economic development and job creation in identified niche sectors.

6.1.4 Green strategies for local economic development of secondary cities

Creating jobs serves as an urbanization pull-factor and thus will attract dwellers to cities. Local economic development and job creation have to be based on coherent strategies in order to maximize their contribution to green growth and sustainable development. The following economic

11 In 2013, LODA prepared for each district a document assessing the local economic development opportunities. These reports are available here: <http://loda.gov.rw/documents/local-government-documents/>

development strategies should guide the actions of the GoR and its administrative entities for the acceleration of job creation in secondary cities and therefore the creation of green jobs.



Strategy 1: **Implement local economic development strategies**

Each district has a document assessing its economic development potentialities. Elaborated by LODA and based on local consultation, this document provides guidance on the existing economic development opportunities within the district boundaries. Also, the document proposed strategies based on key identified potentialities. However, the strategies proposed are very general and are not linked to specific or tangible actions.

Recently, in line with its strong determination to reduce poverty, the GoR has identified five districts that possess common socio-economic issues (Nyaruguru, Ngororero, Rutsiro, Gakenke and Muhanga) and have increased their budget amount.

These districts were targeted for the preparation of a **District Integrated Development Project**. This project includes the preparation of a situational analysis of each district economy and will provide a specific development program. The development program should include technical, economic, financial analysis as well as social and environment profitability. The specific projects will be implemented over a period of five years. Muhanga is already targeted by this project. Considering the strategic significance of local economic development, the preparation and the implementation of a local economic development strategy for each district is critical.

Local industries (retailing, hair salons, dry cleaners, health centres, etc.) are an important source of employment. Local industries provide goods and services primarily to the local market and employment growth tends to be roughly proportional to population growth. Local industries represent approximately 70 to 80% of jobs. On the other side, traded industries are fundamental to prosperity as they generally provide higher wages, represent higher productivity and higher rates of innovation (patenting). Moreover, competitive success of traded industries is fundamental to prosperity as it creates demand for local industries and accelerate economic growth. Traded industries represent only 20% of 30% of jobs

but are essential for sustained growth. Therefore developing these industries is fundamental and should be the focus for the development of a LED strategy.

The local economic development strategy for each district should be based on existing potentialities and the guidelines of the NIP. The development of a local economic development strategy would benefit the implementation of a 'cluster' approach at the national level. As potentialities differ from one city to another, an economic development strategy based on local strengths is essential. Instead of competing against each other and with Kigali for the attraction of investment, the secondary cities must define in their local economic development strategy the industries and the niches that could define their uniqueness. In turn, there should be approaches to how the secondary cities could complement each other and help each other's economic growth. This will help to implement the NIP and will make the country as a whole stronger.

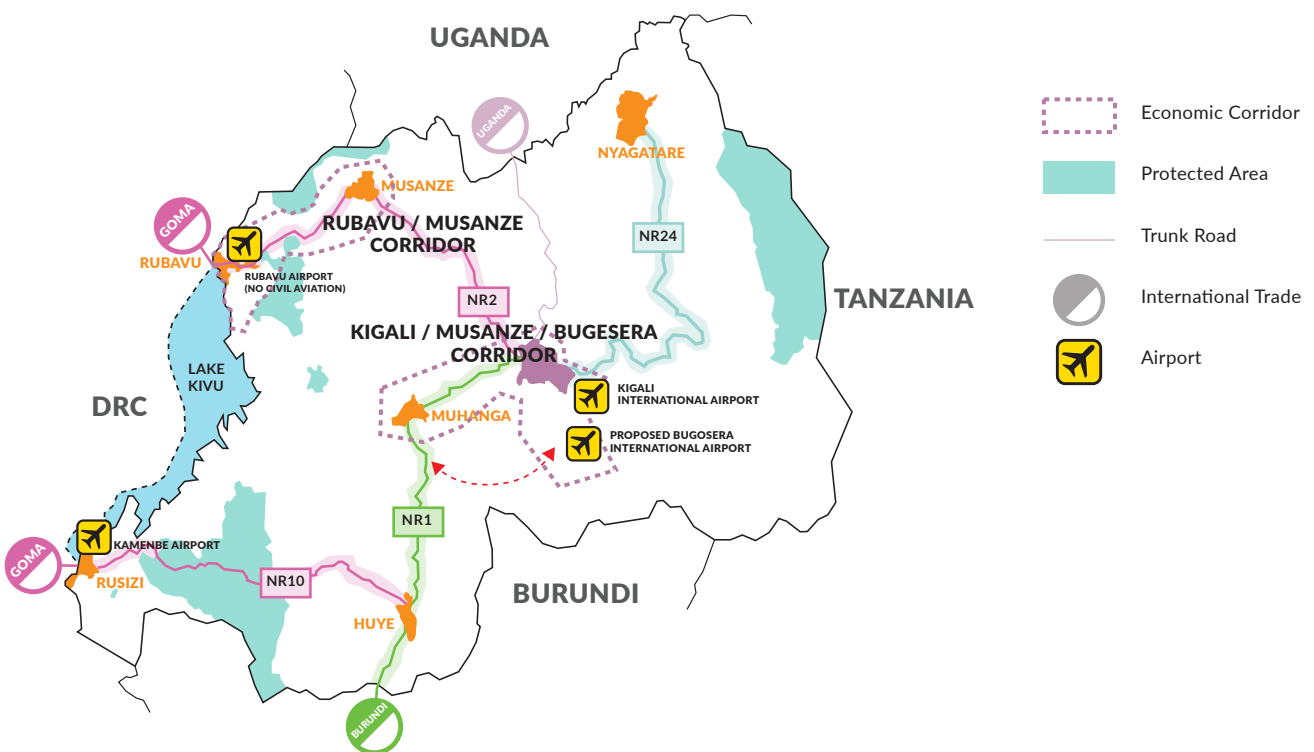
In general, 'clusters' are defined as geographic concentrations of interconnected companies and institutions in a particular field. Clusters encompass an array of linked industries and other entities important to competition. They include, for example, suppliers of

specialized inputs such as components, machinery, and services, and providers of specialized infrastructure. The physical proximity of the players encourages interaction and promotes the exchange of ideas and expertise

Moreover, the local economic development strategy for each secondary city should take into account the existence of prospective strong economic linkages between the city, the rest of the district, the city of Kigali, and other secondary cities. The LED strategy should be the basis to define basic and specialized infrastructure to support all businesses, including traded industries, entrepreneurs and start-ups.

Moreover, the LED strategy should be an opportunity to differentiate a secondary city based on its specific branding. As such, secondary cities need to define their unique positioning within Rwanda and the rest of the world. The NUP Policy Statement 7 states "The valorisation of cultural heritage, the preservation of the uniqueness of each urban area and environmentally friendly development shall be promoted."

FIGURE 36:
POSSIBLE ECONOMIC DEVELOPMENT CORRIDORS



Also, the development of a local economic development strategy in each city must take into account a national vision of economic growth. As shown on the following figure, prioritization of investment on national infrastructure must strengthen natural development corridors that already exist between closely located cities.

For example, Rubavu and Musanze are in a short distance and share a common industry: tourism. Therefore, actions implemented toward attracting more tourism should be part of a shared vision in their respective local economic development strategy. A similar situation exists between Muhanga and Kigali, where economic development is directed towards commerce and trade and having a common vision could only reinforce Kigali and its metropolitan area, including the city of Muhanga.

 **Strategy 2:**
Invest in urban infrastructure and create green jobs

The pillars of urbanization (building, energy, urban mobility, water production, water sanitation, and waste management sectors) are direct enablers of city development. Moreover, as discussed previously they have a direct impact on job creation. Table 20 gives

tangible examples of low-skilled and high-skilled green jobs associated with the pillars of urbanization.

The first action in terms of green job creation consists of directing investment toward the development of infrastructure which will have a direct impact on green growth. Investment decisions should be based on prioritization criteria that promote the multiplier effect in the cities. The ‘multiplier effect’ of infrastructure development is discussed in the last chapter of the NR.

Prioritizing investment in the six secondary cities will enable a greater spread of development initiatives around the country, and through the multiplier effect from these secondary cities, it can in turn have greater levels of positive spillover effects surrounding these areas.

Thereby, at national level, instead of having a dominating hub that spurs development, Kigali, the nation can have an additional 6 hubs to spur development initiatives, Also, the national and local action plans of the NR provide guidance on infrastructure investment that could contribute to green growth and generate green jobs.

TABLE 20:
EXAMPLE OF GREEN JOBS

PILLARS OF URBANIZATION	HIGH SKILLED JOBS	LOW SKILLED JOBS
Green building design and construction	Architect Designer Plumber Electrician	Day Laborer Construction Worker
Energy	Solar water heater technician	Construction Worker
Urban Mobility	Mobility planner Engineer Urban design	Minibus driver Fee collection agent
Water production and distribution	Water treatment engineer	Construction Worker
Sanitation	Sanitation engineer	Sludge collector Sludge stabilization agent
Waste Management	Waste management cooperative manager Waste management engineer	Garbage collector Waste sorting personnel



Strategy 3:

Plan the development of eco-industrial parks in secondary cities

According to the NIP, MINICOM will create industrial parks across Rwanda. Currently four parks are planned and implemented, of which two are near secondary cities (**Huye** and **Rusizi**).

The development of industrial parks will draw upon the positive experience of the **Kigali Free Trade Zone**. To achieve this national project, MINICOM will guide the appraisals of industrial zones where districts will locate areas for local and international investors to set up factories.

Industrial zones can enable industries to be placed closer to the source of the raw materials needed (such as coffee, mineral, fruits and vegetables,) thus facilitating and increasing their productions and in turn creating jobs.

According to MINICOM, the creation of industrial parks follows seven goals:

- Attract investment and generate jobs
- Diversify export sectors
- Overcome land and infrastructure gaps
- Improve regulatory and administrative environment
- Streamline trade procedures
- Facilitate manufacturing agglomeration
- Generate spill-over of knowledge and technology to support upgrading.

The development of green secondary cities and the pursuance of a 'green economy' approach to economic transformation must have a clear mission statement to facilitate and attract investors. To this end, the creation of **eco-industrial parks** in each secondary city would provide great advantages, which in turn is aligned with MINICOM's national objectives.

An eco-industrial park is a community of manufacturing and service businesses located together on a common property. Member businesses seek enhanced environmental, economic, and social performance through collaboration in managing environmental and

resource issues such as waste management and the acquisition of reliable renewable energy.

By working together, the community of businesses seeks a collective benefit that is greater than the sum of individual benefits each company would realize by only optimizing its individual performance.

The goal of an eco-industrial park is to improve the economic performance of the participating companies while minimizing their environmental impacts. Components of this approach include **green design** infrastructure and plants; **cleaner production**; **pollution prevention**; **energy efficiency**; and **inter-company partnering**.

Considering that projects of industrial park are already at the implementation stage in the districts of Huye and Rusizi, the development of **eco-industrial parks** in the secondary cities of Muhanga, Musanze, Rubavu and Nyagatare should become a national priority.



Strategy 4:

Support technical training for green industries

A skilled workforce must support the development of a green economy in secondary cities. Therefore, the education system and the **Technical Vocational Education and Training (TVET)** must address the technical labor shortage and skills gap.

Based on the local economic development strategy and in consideration of industrial clusters identified by each secondary city, the local TVET should be adapted in order to provide a skilled workforce to businesses. Providing technical training and continuous education to workers and students will ensure their ability to perform green jobs. Such an approach requires additional trainers and teachers in fast growing sectors of the green economy. For example, if a city identifies a specific industrial niche in its local economic development strategy, the **Technical and**

Vocational Training Centers¹² should adapt their training in order to provide the skills needed by businesses of this niche sector.



Strategy 5: **Promote the development of a gender sensitive green economy**

The role and status of women in the green economy must be promoted and requires special attention. Fostering the participation of women in the green economy can be a source of political, economic, social and environmental innovation.¹³ Beyond women's comparable capacities to men, women constitute a real potential source of women constitute a real potential source of innovation, and can contribute new perspectives in the areas of management style, company structure, community service, and the use of technology.

Also, a large percentage of green jobs is in sectors where women are less represented in the urban workforce. Jobs in building construction, sanitation, sustainable mobility, wind and solar power production are widely held by men. These sectors make an important contribution to green growth, create jobs and wealth, but they are generally perceived as male-dominated jobs.


Within urban areas in Rwanda, women's employment rates are lower than men's which may be due to urban occupations requiring higher educational levels which puts women at a disadvantage. Significant shifts have occurred in the percentage of women in agricultural self-employment which has declined, while the percentage in unpaid family work increased. This needs to be taken into account for new employment as women's familial commitments will limit their access to these. Among men, the percentage in the agriculture and unpaid family work categories decreased, with non-farm wage employment rising. Gender differences in wage for the 2010/11 period illustrates median monthly salaries were RWF 22,000 for men and RWF 13,200 for women. From 2005/06 to 2010/11 the gender pay gap widened – from 33% to 67%.

12 Technical and Vocational Training Centres (TVTCs) aim at providing recipients with the knowledge and skills necessary to exercise their professional activity so as to access the labour market. Every district counts many TVTC.

13 OECD. Women Entrepreneurs in Small and Medium Enterprises. Paris, 1998.

Rwanda's public works initiative, the Vision 2020 Umurenge Program, could address some of the employment needs of women by offering child care to mothers selected to engage in public works and employ elderly women as childcarers.

A stronger participation of women in green job sectors should be reflected upon and considered from a strategic perspective. Regulation, training and skills-building programs are essential to successfully include women in the developing green economy.



Strategy 6: **Promote green technologies**

Investing in green technologies should be marketable, and financial instruments should help promote the adoption of these technologies. Overall these measures will help the economy transition to a green economy. However, this transition is a paradigm shift that might be challenging. Notably, for existing companies it might represent significant changes in business practices or modes of production. Therefore, the transition to a green production of goods and services needs support and technical expertise.

Businesses need to be supported in order to accelerate the transition to a green economy. In order to promote green technologies and green mode of production, nothing is more effective than success stories, especially within Rwanda or from a country with similar economic characteristics.

The first priority would be to identify the sectors of activities targeted by the **NIP** and assess their environmental impact with the collaboration of key actors of this sector.

For example, for the coffee washing industry, this means identifying green practice in Rwanda and abroad, and support the implementation of these sustainable practices in currently non-green businesses. Moreover, considering the strategic importance of coffee production for the country, the development of green washing technologies (using less water) should become a national objective involving the business community and the academia.



Strategy 7: Support green entrepreneurship

Green entrepreneurs need financial and technical support. As such, facilitation for access to capital is critical. In many countries, green investment funds (loans and grants) supported by venture capitalists, the private sector, or the government contributes to the promotion of green entrepreneurship and green jobs creation. The creation of such a fund in Rwanda, specifically targeting secondary cities' entrepreneurs, is relevant.

In addition, the promotion of **women's entrepreneurship in the green economy** should be at the core of any program facilitating the access to capital. This should happen in conjunction with existing initiatives supporting the development of women's business skills.

Also, the GoR and its entities could support green businesses by favouring green products and services in its procurement practices. Promoting the acquisition of green materials (for example, for the construction of roads), green technologies, and green services will boost the green economy. The government has a key role to play with regard to the promotion of green products and services. Government interventions can strongly influence the transformation to a green economy by imposing changes in the way business is done in the country.

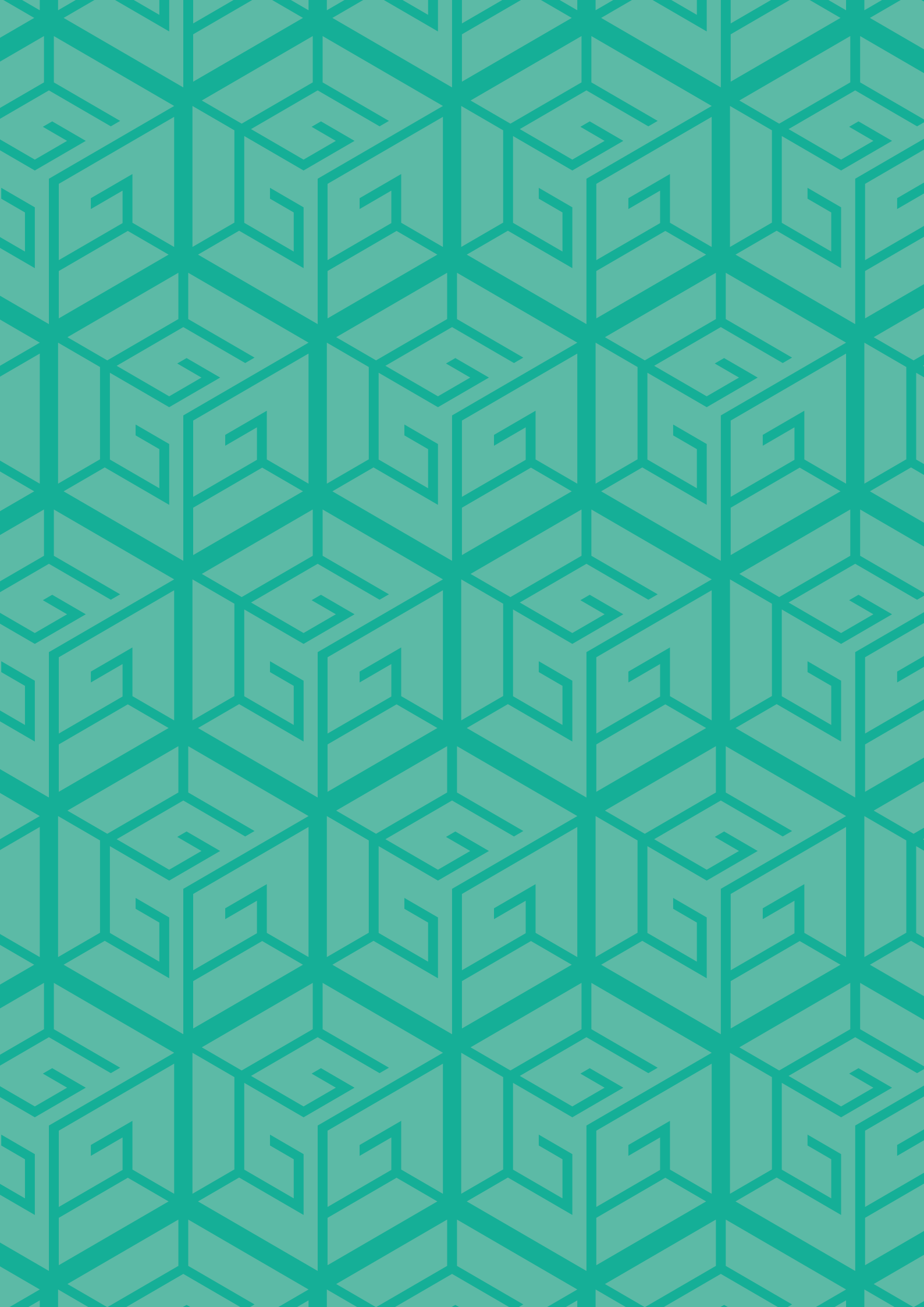
Also, the GoR and its entities could support green businesses by favouring green products and services in their procurement practices. Promoting the acquisition of green materials (for example, for the construction of roads), green technologies, and green services will boost the green economy. The government has a key role to play with regard to the promotion of green products and services. Government interventions can strongly influence the transformation to a green economy by imposing changes in the way business is done in the country.



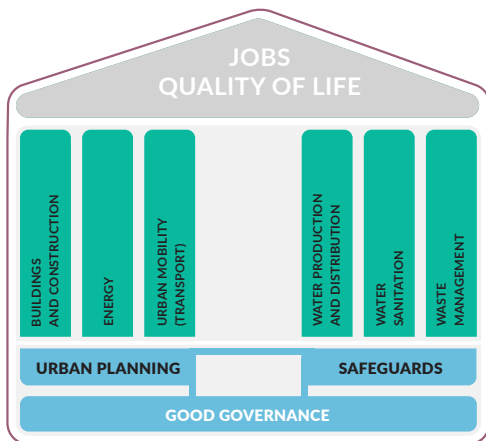
Strategy 8: Assure compliance with green jobs safeguards

Green jobs encompass more than just the extent to which a particular job contributes to a more environmentally sustainable economy. They also capture a measure of job quality. Effectively, a job may be associated with an economic activity that is more environmentally sustainable, but it won't be considered a green job if it does not meet conditions of decent work, this implies a set of social and labor rights and obligations.

Many low-skilled green jobs involve direct contact with dangerous material (for example industrial process or sanitation-related sludge) or take place in dangerous settings (construction of new buildings). Moreover, low-skilled green jobs are often defined by their informal nature, hardship and occupational and health hazards. Therefore there is a need to enforce laws and regulations to protect workers' conditions.







6.2 Quality of life

Another characteristic of urbanization to consider from the development of the foundations and pillars of green urbanization, along with job creation, is the quality of life. Direct improvements to the quality of life for the urban dweller compared to that of the assumed worst conditions in the rural areas, serve as a pull factor for urbanization.

Improving the quality of life touches upon happiness levels of a city, where citizens are happier and businesses are making more profits. In order to achieve this, happiness in a city depends on the improvements of the access to efficient public services (such as education, health and the infrastructure sub-sectors included in the pillars of urbanisation in this NR that avoids the negative outcomes of urbanization), and improving the potential for the acquisition of value added opportunities (such as employment opportunities and ability to acquire further desired skills). This means that an enabling government can directly intervene and therefore directly impact the quality of life in a city. In addition, the government will be able to develop cities to achieve the national urbanization targets and, in turn, accelerate progress of other development priorities.

Considering the potential low-income dwellers of the secondary cities, it is important to consider the component of affordability to any public service providing that it improves the quality of life. Being excluded from benefiting from a better quality of life because it is costly, negatively affects the happiness level of a citizen and overall any growth the city faces will not be socially

inclusive. Moreover, migration and wider quality of life issues need to have a clear gender analysis.

6.2.1 Green strategies for improving the quality of life in secondary cities

Green strategies to improve the quality of life in secondary cities of Rwanda involve improving the happiness level of cities, whilst taking into account environmental and social impacts to society. As outlined above, the following characteristics directly affect the quality of life in the urban setting: (i) improved access to and efficiency of public services, and (ii) improved access to economic opportunities that adds value to a citizens' life. In order to make these green strategies, the first, (i), is already explored through the green guidelines of the pillars of urbanization in this NR, and the second, (ii), is already explored through the green guidelines of the job creation chapter in this NR. It is crucial to achieve and integrate, where possible, the proposed green guidelines for infrastructure to achieve social inclusiveness through the foundations of urbanization (urban planning, good governance and safeguards).

There are two missing components that have not been covered in this NR that directly contribute to the improvement of the quality of life of an urban dweller: the provision of accessible and affordable basic services in cities (education and health), and the facilitation and improvement of the quality of life of urban families.

Strategy 1:
Provide accessible and affordable basic public services in cities

Urban growth has a significant positive correlation with economic growth, but is highly dependent on the the provision of accessible and affordable basic services in cities: Education and Health.

The acquisition of primary, secondary and tertiary education gives citizens the opportunity reach a knowledge threshold depending on respective level of education and the opportunity to gain valuable skills. These are trickled back into the growth of society as the citizens apply the knowledge and skills, and altogether

have a common understanding of various topics. This gives further opportunities for the citizen in regard to choosing a desired field of work. There is a great need to have an enabling environment for this specialization in order to satisfy the citizen and to enable society to absorb the benefits associated with the field of work itself.

Access to health facilities anywhere in the world is essential for survival. Therefore, a city without adequate health facilities does not offer the inhabitant the basic necessity to sustain a healthy life. The high levels of vitality that a city brings increases the probability of disease spread and the risk of accidents such as from transport. Health facilities reduce this probability and risk, and overall reduce fatality. In addition, the city itself is healthier, thereby positively affecting overall productivity levels of workers and therefore contributing to economic growth.

As the city faces positive urban growth, the population growth would pose increasing pressures to the efficiency and quality of the basic public services and therefore to the quality of life of city dwellers. Therefore, it is crucial to sustain investments into these sectors (education and health), especially as they are both globally progressive.

In regard to secondary city development, it is essential to assess the gaps of accessible and affordable education and health facilities for citizens. Based on the assessment of local economic development opportunities, realized by LODA, most districts have an insufficient number of adequate learning spaces, the pupil classroom ratio is too high, and basic infrastructure (water and sanitation) is often lacking in schools.

As such, getting the educational and health facilities of secondary cities at the level of national standards is a priority. Prioritizing action on secondary cities will improve the attractiveness of these urban environments for rural migrants.



Strategy 2: **Facilitate and improve the quality of life of urban families**

The potential urban dweller to secondary cities in Rwanda will not only most likely be a low income dweller, they will also be likely to have a family. A city needs to accommodate the needs of a quality family life: a child friendly city. In addition to the proposed green guidelines for the foundations and pillars of urbanization stated in this NR, the acknowledgement of the importance of family life to the quality of life of a city will increase city vitality. Families pose higher demands to the economy, such as for schools, food, recreational activities and childcare, and they contribute to the safety and liveliness of a neighbourhood. However, a city that is not efficiently planned with this consideration will constrain these benefits and therefore constrain the optimal level of life quality a city can have. With an increasing level of urbanization, these constraints will be enhanced with time.

The Government of Rwanda (GoR) has initiated several steps in the direction of addressing the rights and needs of children in the country: various social policies have been enacted; plans have been developed; and programmes have been implemented (such as the Integrated Child Rights Policy and Early Childhood Development Policy). In addition, priorities for 'the good child development and parenting' are high and at the core of government action.

The costs of not investing on children, youth, and families are enormous. Many of these costs are faced by district administrations: as urbanization increases, spending on public services and safety rises whilst the strength of the local workforce and economy is undermined. As such, offering services to families, notably in the context of early childhood development is critical and represents a pull factor of urbanization.¹⁴

Early Child Development is defined by UNICEF as a comprehensive approach to policies and programmes for children from birth to eight years of age, their parents and caregivers. Its purpose is to protect the child's rights to develop his or her full cognitive, emotional, social and physical self.

The **Early Childhood Development Policy** of the GoR establishes that an **Early Childhood Development and Family Centre** (ECDFC) has to be established in every district. Through this initiative, the GoR recognizes the importance of community and culture in child development and aims at fostering good health and nutrition practices among parents. A ECDFC is a place where high impact services to families and communities are provided. The services include education in parenting: early learning, nutrition, water, sanitation and hygiene, health, and child protection. Also, a ECDFC offers child-care services to working mothers.

The development of ECDFC in secondary cities will contribute to enhance the provision of services targeting urban families and will contribute to poverty reduction efforts, which overall improves the quality of life for an urban dweller.



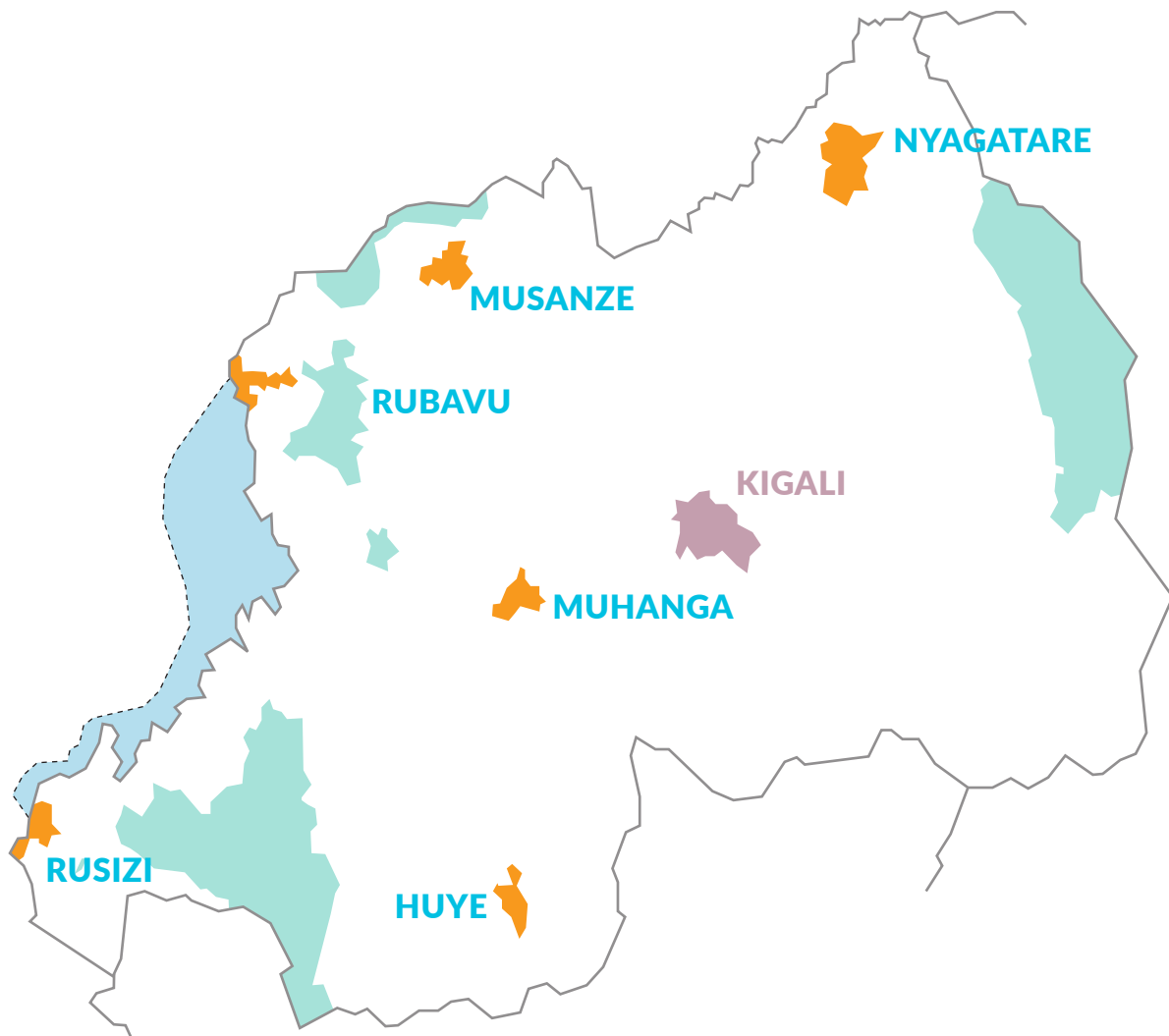
7. District profiles and LED potentialities

Each district has: distinct characteristics, a specific history, and a unique development vision. As the secondary cities are at different stages of development, the next section of the NR compounds six profiles representing each of the secondary cities, and illustrates the available resources, current activities and the current constraints of each city. This helps to identify and link the gaps and potential opportunities to the pillars of urbanization of this NR.

The local action plan of each secondary city reflects the opportunities arisen from history, natural features, geographical location and social features of the district.

These profiles are based on an analysis of national and local planning documents and potentialities identified by LODA. Also, the identification of potentialities is based on the results of a the GGGI consultation process that took place in July 2015.

FIGURE 37:
THE SECONDARY CITIES OF RWANDA





7.1 The secondary city of Huye

7.1.1 Profile

Huye is situated in the Southern Province, which has an area of approximately 5000 Ha. Huye City is comprised of three spatial sectors: Tumba, Ngoma and Mbazi, which, in turn, determine the urban boundary of Huye District. In 2012, Huye District's population size was 328,398 inhabitants and Huye City's population size was 52,768 inhabitants (16% urbanized), where the urban population growth rate was 1.9%. The mean size of urban private households in 2012 was 3.9 persons.

The city is known for its rich intellectual capacity, where it has several academic institutions and the largest campus of the University of Rwanda, and is also considered Rwanda's cultural and historic pulse, where it hosts the National Museum and the Royal's Palace.

The business landscape of Huye is characterized by the presence of 1,876 firms (46% growth), of which 8 are large firms, 50 medium firms and 77 are cooperatives. The city has an industrial park and Agakiriro Center is adjacent. The city has seven TVET centres.

In addition the local economy is driven by the agricultural and manufacturing sector, where it produces high amounts of various food crops, and possess expertise in tin processing, brick making, carpentry, handcrafting and pharmaceuticals. In terms of the tourism industry, the city has 21 hotels and 540 rooms. In particular, potentialities in Huye include the following listed below.

7.1.2 Potentialities¹⁵

Academic, research, and culture

The secondary city of Huye is home to the National University of Rwanda and the North Gate University of Rwanda. It also held the prestigious Nyakibanda Seminary, the Rwandan National Institute of Scientific Research, and the Ruhande Arboretum. Therefore the city offers a *masse-critique* for education and scientific research. Moreover, due to the large number of university students and student-centered activities in the city, Huye is often regarded as a university town.

High soil fertility

Huye already has the skilled farmers; land for coffee expansion; an active private sector; a comparative advantage in rice; installed small processing plants; expertise from NUR; swamps suitable for rice production; bee-keeping and mushroom seeds production which is already active; and the high local demand for these products. However, there exist obstacles to fully embrace these opportunities: there are insufficient local agricultural technicians; inadequate added value to agriculture production (lack of packaging and processing), lack of skills in agro-business; unskilled farmers in modern farming techniques; a low number of people accessing business financing facilities and financial services; a low SACCO repayment of loans; and soil erosion. In addition, this potentiality poses further opportunities that foster the city's economic growth from benefits gained externally. Huye already has an existing market for exports; various partnerships with stakeholders within the coffee industry, where gaining modern farming techniques, post harvests and export promotions; high regional demand for the products; and there is an untapped export market for mushrooms with a high demand across the EAC. However, current obstacles to taking advantage of these opportunities are that the regional competition for rice, coffee and honey production is high, and the demand is affected by the recent global financial crisis.

¹⁵ Potentialities of each district are based on the District Development Potentialities elaborated by LODA in 2013, World Bank analyses, and GGI analyses.

Tourism

Develop natural and cultural sites as touristic attraction, develop arboretum as a touristic attraction, and develop an artificial lake between Huye and Save. Currently the Huye peak and its surrounding mountains (Ibisi bya Huye) are a beautiful site for tourism as it possesses historical background (Nyagakecuru history). The national museum and its related assets like Ikibuye cya Shari, Mont Kinyamakara, Mont Mwulire are other valuable tourist sites. In addition, there is a touristic and scientific opportunity to explore the over 3000 species of trees and monkeys. Current constraints to developing these opportunities consist of the limited capacity to use multi-lingual services; insufficient basic infrastructure; and unskilled labor including in the hospitality sector. Overall, Rwanda has posed great facilitation opportunities for tourism development into action from the support of RDB to respond and encourage further demand of tourism services.

Energy production

The presence of waterfalls serves Huye with an opportunity to use its rivers for energy generation to directly serve the high local electricity demand (households, centres, schools and health centres). There are already the SACCO and other financial institutions that are interested in facilitating this. However, there is a lack of local electrical engineers; limited environment specialists; lack of local investors to intervene in hydropower sector; and there is a low purchasing power for electricity for local communities. In addition, the private sector faces high costs for the project itself and climate change can reduce the rainfall thereby creating a large risk affecting the profitability of the project.

Abundance of water springs

Huye has a large presence of water springs, which poses the opportunity to manufacture this high demanded resource into packed drinking water. However, there is currently a lack of skilled water technicians; limited environment specialists; and a low purchasing power for packed water for local communities; and a high cost for water processing along with its technologies.

7.1.3 Branding concept for Huye: The Knowledge and Culture Hub

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Huye should be based on the concept of the city being a centre for **Knowledge, Culture and Agribusiness**.

7.1.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Huye:

- Education and academic research
- Agribusiness (food and beverage, coffee culture and washing, dairy and livestock, seed production)
- Building fixtures and wood crafting
- Pharmaceutical research and drug manufacturing
- Tourism based on historic and natural attractions, academic tourism (conference)
- Handicraft (leather shoes, carpentry, metalwork, tailoring, ornamental items)

7.1.5 Accelerating growth in Huye

Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and - ideally - be associated to a multiplier effect.

Based on the prospective local clusters identified for Huye, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of a waste management plan and construction of a waste management facility
- Development of a sanitation strategy (in order to transform and reuse the sludge produced by local institutions such as universities, hotels, and museum)

- Expansion of the industrial park in order to attract agribusiness, research, pharmaceutical and building materials
- Implementation of a strategy to attract the pharmaceutical industry
- Acceleration of knowledge transfer between research institutions and industry
- Generation of electricity from hydropower
- Development of agri-business vocational training
- Development of tourism vocational training
- Development of the road network and implementation of green transport modes, notably targeting students

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.



7.2 The secondary city of Muhanga

7.2.1 Profile

Muhanga district is situated in the Southern Province of Rwanda covering a land surface area of 647,7 km². Muhanga City is comprised of three spatial sectors: Shyogwe, Nyamabuye and Cyeza, which, in turn, determine the urban boundary of Muhanga district. In 2012, the district's population size was 319,141 inhabitants and Muhanga City's population size was 50,608 inhabitants (16% urbanized), where the urban population growth rate was 2.6%. The mean size of urban private households in 2012 was 4.1 persons. Out of the six secondary cities, Muhanga is the closest to Kigali, where most of its economic production is transported there, and has the slowest population growth rate.

The business landscape of Muhanga is characterized by the presence of 2,835 firms (28% growth), of which 4 are large firms, 52 medium firms and 45 are cooperatives. A 40 Ha site has been identified for an industrial park.

Muhanga city is known as the commercial centre of Rwanda and can potentially be the financial hub of Rwanda. However, currently the agriculture sector dominates the economy employing nearly 80% of Muhanga district's workforce. The other dominating sectors are trade, industry and construction. A number of mining operations are active in Muhanga, but the mineral processing plant operates at only 20% capacity. Muhanga's main produced goods are pottery, fashion and tailoring, furniture, maize and mushrooms. In terms of the tourism industry, the city has 18 hotels and 316 rooms.

7.2.2 Potentialities

Strategic location for trade and logistics

Though officially part of the Southern Province, the secondary city of Muhanga is geographically in central Rwanda, approximately 45 kilometres by road southwest of Kigali. Due to its geographical location, the city serves as the gateway to the west and south of the country. This central location is strategic and the availability of land (compared to Kigali) offers alternatives for businesses in need of space at proximate distance to the capital.

Mineral deposits and quarries

Muhanga city currently has an abundance of mineral deposits such as white clay, sand, limestone and coltan. To complement this, there is local expertise in clay processing; an emerging stone industry; established mining cooperatives; available man-power; and an existence of interested mining investors. In addition, there is a supportive environment that can help Muhanga exploit this potential: the existence of laws and regulations; established financial institutions; support from the Private Sector Federation (PSF); and support from TVETs. However, constraints to embrace this potentiality lie on the weak technical capacity of operators; lack of mining and clay industry specialists and technicians; lack of strategic financial services and knowledge; limited number of investors due to the costly mining equipment and the limited profitability because these commodity goods' value fluctuate according to international prices; the high risks tied to the destruction of the environment; and the lack of poor road networks on mining sites.

Craft industry

Muhanga has available technical cooperatives and artisans with rich skills of crafting, which are matched with a high market demand for their products and in turn, increases demand for further skilled labor. To support this industry, there exist the following: a high number of emerging formal and informal establishments that offer apprenticeships; technical and vocational schools; a pool of abundant youth population; and strong financial institutions. However, there are insufficient teachers, trainers, school facilities and equipment; the partnerships between TVETs and other technical establishments, such as internship and employment, are weak; there lacks basic infrastructure including energy, water and sanitation;

there is high competition locally and internationally; start up costs are high due to the cost of the equipment; and there is a high reluctance among the youth to enroll in TVETs and craft industry.

Best land for livestock

In Muhanga, there is currently a high number of quality improved cattle breeds in well managed zero grazing system. This has further benefitted Muhanga by: high production of competitive quality milk; a growing interest in small livestock (goats, pigs and chickens); an increasing local demand for animal products; the existence of Girinka and other livestock promotion programs; and the availability of modern farming techniques. To support further developments for this potentiality there is the existence of the Agricultural Guaranty Fund and the Business Guaranty Fund, and governmental support through micro loans from SACCOs. However, the lack of veterinary services and modern slaughterhouses limit the progress of this industry. In addition, there is a lack of skills in agribusiness; there is a low rate of people accessing financial services; there is a low SACCO repayment rate; there is a reluctance to use modern farming techniques; and the lack of basic infrastructure limits further development, such as roads and security of energy.

Tourism

Muhanga City has the potential to become a hub for various tourist attractions spread across Muhanga district, such as Rucunshu, Kankazi initiatives, Museum of Women, Busaga Natural Forest and Kabgayi Faith tourism. Muhanga's location is particular advantageous due to its low proximity to Kigali and its well connected roads to the North, South, East and West of Rwanda, which guarantees an influx of tourists. There are already high demands of the service sector as a result of tourism. The availability of ICT services and the existence of the national strategy to promote tourism along with RDB's support to institutions further supports the growth of this potential. There is a need to exploit this help and deal with current constraints: touristic sites not developed; there are an undeveloped hospitalization market to accommodate the visitors or tourists; there's limited language skills; lack of strategic knowledge of financial services such as Public-Private Partnerships (PPP); and the high local and international competition.

7.2.3 Branding concept for Muhanga: The Logistics and Trade Platform of Rwanda

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Muhanga should be based on the concept of the city being a centre for the **Logistics and Trade Platform of Rwanda**.

7.2.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Muhanga:

- Trade and logistics
- Agribusiness (pineapple, maize, sweet potatoes, bananas, mushrooms, coffee and honey production)
- Livestock breeding and transformation (cattle, goats, sheep, pigs, poultry, rabbit)
- Handicraft (tailoring, pottery, fashion, furniture)
- Mining and mineral processing (coltan and cassiterite)
- Tourism (national tourism targeting Christians)

7.2.5 Accelerating growth in Muhanga

Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and – ideally – associated with a multiplier effect.

Based on the prospective local clusters identified for Muhanga, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of a waste management plan and upgrading of the waste management facility
- Development of an industrial park for agro-processing local produce and rice, export promotion for retail consumption
-

- Implementation of a strategy to attract the logistic industry
- Development of the mining and mineral transformation industry
- Construction and operationalization of Agakiriro Center
- Generation of electricity from hydropower
- Development of mining vocational training
- Development of the road network and implementation of green transport modes

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.



7.3 The secondary city of Nyagatare

7.3.1 Profile

Nyagatare is situated in the Eastern Province, possessing an area of approximately 5000 Ha. The city is comprised of three spatial sectors: Nyagatare, Rwempasha, and Tabagwe which, in turn, determine the urban boundary of Nyagatare District. In 2012, Nyagatare District's population size was 465,855 inhabitants and Nyagatare City's population size was 47,480 inhabitants (10% urbanized), where the urban population growth rate was 9%, which is as high as Kigali City but in real terms is much less. The mean size of urban private households in 2012 was 3.9 persons. While Nyagatare City is growing rapidly, it remains the least densely populated out of the six secondary cities. Overall, there is a lack of infrastructure, such as water and energy, posing increasing levels of difficulties to accommodate and provide services to the the new urban dwellers.

The business landscape of Nyagatare is characterized by the presence of 1,915 firms (41% growth), of which 3 are large firms and 50 medium firms. A 50 Ha site has been identified for an industrial park outside the city.

Nyagatare has a lot of available land, which is flat unlike the stereotype that follows Rwanda: "the country of a thousand hills". It is known for its high soil fertility, cattle breeding and thereby dairy production, where is the Inyange factory is based, its industrial exploitation of granite, and its close proximity to the National Park Akagera, which brings touristic opportunities.

7.3.2 Potentialities

Suitable land for livestock

With the rich amount of farmland available, the favorable climate, livestock promotion programmes and livestock specialized institutions, the district has the highest number of livestock in the country: there exist 12 milk collection centres of installed capacity of 71,000 liters; there exists 8 modern markets for cows in sectors around the city and there exist Rwanda's dominant milk company called Inyange Industry. However, even though there exists financial institutions, there are a low number of people that are actually accessing financial and business services. Also, even though there are veterinary specialists, their expertise is limited due to high rates of livestock diseases. Finally, the lack of infrastructure, especially energy for industrial use, limits productivity levels.

Granite Rock and Quarries

Further opportunities for granite extraction are facilitated by the following factors: already established quarries, the presence of the East Africa granite industry's office, and active environmental officers and mining investors. In addition, the national laws and regulation for granite have been established to facilitate distribution of material to meet domestic and international demands that are readily active.

Although there is an ample amount of man power, Nyagatare lacks mining specialists and technicians to increase its existing low capacities of operations as they use artisanal techniques. In addition, the mining equipment incurs high costs to the potential investor; for further mining of granite means the destruction of the environment; and as it is a commodity good, it will be sensitive to global price fluctuations so investors bear higher risks and face international competition, both of which affect the investments' profitability. Finally, the determining infrastructural factor constraining the overall distribution of granite is the quality of roads., Nyagatare is in need to improve the quality of its roads to provide better transportation methods.

Tourism

Nyagatare is uniquely positioned at the north entrance of the National Akagera Park, where it already faces a high demand for tourism. In addition, Nyagatare also has a collection of unique tree species along Umuvumba river and historical sites. With the establishment of the Rwanda Development (RDB) and the national strategy for tourism promotion, Nyagatare is able to develop this opportunity further. The current constraints include: the lack of built hospitality services and the high tourist competition from Rwanda itself and internationally, in Uganda and Tanzania, as they are all more developed and have multiple tourist activities.

7.3.3 Branding concept for Nyagatare: The Commercial Agri-Centre of the East

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Nyagatare should be based on the concept of the city being the **Commercial Hub of East and the Dairy Centre**.

7.3.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Nyagatare:

- Extensive farming and transformation
- Livestock breeding and transformation
- Agro-processing (rice, maize, milk)
- Mining and mineral processing (granit)
- Tourism (wildlife, Akagera National Park)

7.3.5 Accelerating growth in Nyagatare

Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and - ideally - be associated with a multiplier effect.

Based on the prospective local clusters identified for Nyagatare, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of a waste management plan and upgrading of the waste management facility
- Development of the industrial park in order to attract agribusiness, packaging facilities, and logistic industry
- Development of veterinary and animal control facilities
- Implementation of a strategy to attract the logistic industry
- Development of roadside services for trucks and development of the border crossing facilities at Kagitumba
- Planning of an international railway stopping point for facilitation of exports
- Development of the mining and mineral transformation industry for granite
- Development of agribusiness vocational training
- Development of the road network and implementation of green transport modes

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.



7.4 The secondary city of Rubavu

7.4.1 Profile

Rubavu is situated in the Western Province of Rwanda. The city is comprised of seven spatial sectors: Gisenyi, Rugerero, Nyamyumba, Nyundo Kanama, Nyakiliba and Rubavu, which, in turn, determine the urban boundary of Rubavu district. In 2012, the district's population size was 403,662 inhabitants and Rubavu City's population size was 149,209 inhabitants (37% urbanized), where the urban population growth rate was 5%. The mean size of urban private households in 2012 was 4.3 persons. Out of the six secondary cities, Rubavu has the second fastest growing population rate and has the highest population density, which both surpass the national average and makes it the fastest urbanizing city.

The business landscape of Rubavu is characterized by the presence of 5,050 firms (21% growth), of which 7 are large firms and 67 medium firms. The city has 62 hotels and a total of 765 rooms. Rubavu is home to two universities, notably the Rwanda Tourism University College.

Rubavu, similar to Musanze, is known as the tourist hub of Rwanda mainly because of its unique location in the North of Lake Kivu; it also shares a border with Goma, DRC. While tourism is a significant part of Rubavu's economy with many lake view hotels and opportunities to access the Congo Nile road by bicycle or car, it remains underexploited. Rubavu has several large industries that provide employment for its local population: It is home to Bralirwa Breweries, a beverage manufacturer that produces beer and juices; and is where the first Rwandan

independent power project, methane gas project, KivuWatt, is situated.

7.4.2 Potentialities

Trade and logistics with DRC

In Rubavu, there is a very level of transactional activities between Rwanda and the DRC and the city's close proximity its very close proximity makes it attractive for further business and also increases government revenue through taxes: there are 12 modern public markets and 41 trade centres in Rubavu alone that enable and facilitate these transactions. The high demand of local products from both Rwanda and the DRC keeps the transaction levels profitable. The existence of modern financial services, ICT infrastructure and international travel agencies further facilitates cross border trade with the DRC. However, factors that constrain the optimal benefits of trade include: the low levels of skills in business development; poor food processing techniques including packaging for trade; high levels of tax avoidance; and the existing high levels of regional competition.

Tourism

Rubavu's main attractions include Lake Kivu, Gishwati Natural Forest and Virunga National Park (situated in Goma). Rubavu has the capacity to accommodate the large constant influxes of tourists into attractive hotels and guesthouses along Lake Kivu. The availability ICT services and the growing services sector, including the cultural offers, dance clubs and restaurants provides the tourists with additional desired services, which in turn contributes to Rubavu's economic growth. RDB, the National Strategy for tourism promotion and the fact that Rubavu is one of the National Destination Management Areas (DMA) further supports the development of this sector. However, the city faces certain constraints, such as: limited language skills, poorly developed infrastructure, lack of skilled workforce and poor exploitation of Lake Kivu's beaches.

Maritime Transport

Situated on Lake Kivu, Rubavu occupies a strategic location for national and international travelling. The large brewer and soft beverage company, BRALIRWA has its headquarters based in Rubavu and already uses maritime

transport to disperse its goods within Rwanda and to the DRC. The connections within Rwanda include the other secondary city, Rusizi, and a connection internationally is to Goma. There is therefore room to exploit these connections further, especially, that of Rusizi. Current challenges for this include the lack of skilled local workers; there is a need for further investments in port construction; there is a shortage of ships; there is a lack of maritime technicians; and the existence of competing road transport reduces demand for maritime services.

7.4.3 Branding concept for Rubavu: The Lakeside Hub for Tourism and Industry

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Rubavu should be based on the concept of the city being an the **Lakeside Hub for Tourism and Industry**.

7.4.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Rubavu:

- Logistics and transport (road and maritime)
- Tourism (international and national)
- Agribusiness (food and beverage, fishing, and fruits and vegetables)
- Energy production
- Handicraft (tailoring, pottery, fashion, furniture)

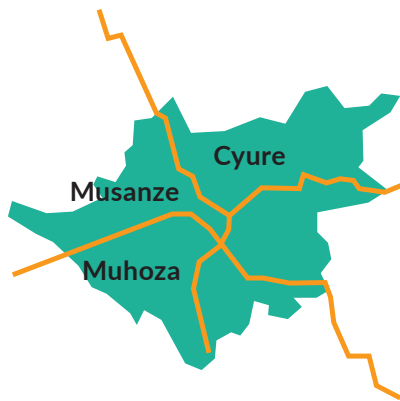
7.4.5 Accelerating growth in Rubavu

Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and - ideally - be associated to a multiplier effect.

Based on the prospective local clusters identified for Rubavu, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of new tourist attractions (development of water sports on lake Kivu, development of a public park on Mount Rubavu, improvement of the centre of the city, etc.)
- Development of a waste management plan and upgrading of the existing waste management facility
- Development of a sanitation strategy (in order to transform and reuse the sludge produced by local institutions such as universities and hotels)
- Development of an eco-industrial park in order to attract green agribusinesses
- Implementation of a strategy to attract the logistic industry
- Development of the road network and implementation of a public transport system in urban areas

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.



7.5 The secondary city of Musanze

7.5.1 Profile

Musanze is situated in the Northern Province. The city is comprised of four spatial sectors: Muhoza, Cyuve, Kimonyi and Musanze, which, in turn, determine the urban boundary of Musanze district. In 2012, Musanze district's population size was 368,267 inhabitants and Musanze City's population size was 102,082 inhabitants (28% urbanized), where the urban population growth rate was 1.8%. The mean size of urban private households in 2012 was 4.4 persons. It has the second highest population density of the six secondary cities but is not matched with a high population growth. Musanze is one of Rwanda's most developed districts having the lowest rate of poverty outside of Kigali.

The business landscape of Musanze is characterized by the presence of 3,851 firms (1% growth), of which 10 are large firms and 68 medium firms. The city has 51 hotels and a total of 821 rooms. Musanze has an industrial, which is underdeveloped.

Musanze is known as the tourist hub of Rwanda, where it hosts eco-tourism activities such as Gorilla trekking and Volcano trekking at the Virunga National Park, and cycling where the Rwanda Cycling team base is. The high frequency of constant tourism guarantees a constant influx of demand for the service sector. Overall, the economy is driven by eco-tourism, construction materials, Irish potatoes, jewelry-handcraft and rose and geranium essential oil.

7.5.2 Potentialities

Tourism

The existence of the Virunga Volcanoes and the Twin Lakes (Ruhondo and Burera) close Musanze City is already driving the local economy through constant influxes of income into the service sector directly from the tourists themselves and indirectly from the Tourism Funds managed by RDB following the national strategy for tourism promotion, where the revenue comes from tourism permits and then is disbursed back to Musanze through public project investments. In addition, Musanze is also considered a transit city to the other touristic secondary city of Rwanda: Rubavu. The close proximity to both Rubavu and Kigali sets Musanze in an opportune position for further development of tourism and trade, and thereby urbanization opportunities. However, the general low limited establishment of infrastructure and the lack of skilled workers affect the prospects of these opportunities.

Agro-processing

Electricity access enables agro processing activities in Musanze such as its large livestock population, which means a large production of staples for livestock feeding the SOTIRU maize processing industry. In addition, the already existing laws and regulations along with the establishments of financial institutions and the support of the private sector federation, enables further prosperity for the growth of Musanze city. However, the lack of agro-industrial specialists for agro-processing and business management constrain these opportunities.

Mineral Deposits

Musanze district has high supplies of Coltan, Wolfram, Travertine, Cassiterite and Volcanic stones. The presence of reliable water resources facilitates mining operations. The SACCO and financial institutions are active in supporting the mining business, where they face responsive market demands both internationally and locally, and an existence of an attractive investment environment with already interested investors. Laws and regulations already exist for mining operations. However, these opportunities face certain challenges: there is a high cost of mining equipment; mining generally involves the destruction of the environment; and profitability of this market is directly affected by the global financial crisis and international market fluctuations due to having the characteristic of being commodity goods.

Pisciculture

Musanze City has the advantageous opportunity to have the advantageous opportunity of having an active fish market: the high demand, arises through the city's advantage of being close in proximity to Lake Ruhondo. Additionally, the presence of electricity access and road infrastructure enables efficient storage of fish in fridges and transportation; the presence of financial institutions directly supports pisciculture business; and the additional demand from Kigali stimulates the market further.

Constraints for further development lie on the lack of expertise for pisciculture; insufficient skills and capacity in applying modern pisciculture techniques for increased production; and the high local and regional competition means profitability is low.

7.5.3 Branding concept for Musanze: The Eco-Tourism City

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Musanze should be based on the concept of the city being the **Eco-Tourism City**.

7.5.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Musanze:

- Tourism (international high-end eco-tourism)
- Sports and culture
- Agribusiness (livestock breeding and transformation, fish farming, fruits and vegetable, rice, pesticide production)
- Building materials

7.4.5 Accelerating growth in Musanze

Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and - ideally - be associated a multiplier effect.

Based on the prospective local clusters identified for Musanze, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of new tourist attractions and tourism infrastructure (hotel, tourism board, etc.)
- Development of a waste management plan and development of a waste management facility
- Development of a sanitation strategy (in order to transform and reuse the sludge produced by hotels)
- Development of an eco-industrial park in order to attract green businesses
- Development of the road network

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.



7.6 The secondary city of Rusizi

7.6.1 Profile

Rusizi district is situated in the Western Province of Rwanda. Rusizi City is comprised of two spatial sectors: Kamembe and Gihundwe, which, in turn, determine the urban boundary of the secondary city. In 2012, the district's population size was 400,858 inhabitants and Rusizi City's population size was 63,258 inhabitants (16% urbanized), where the urban population growth rate was 2.4%. The mean size of urban private households in 2012 was 4.6 persons. Rusizi has the second highest population of the six secondary cities. It is the furthest secondary city from Kigali bordering with DRC and Burundi, which has led it to sustain a substantial amount of trade and logistics opportunities.

The business landscape of Rusizi is characterized by the presence of 1,965 firms (7% growth), of which 11 are large firms. The city has 12 hotels and a total of 240 rooms. The airport of Kamembe offers a daily direct flight to Kigali.

Rusizi is known as one of the largest commercial hubs in Rwanda, although the agriculture sector employs the majority of the workforce. In addition, economic opportunities already exist in other sectors such as trade and low-tech industry. In particular, Rusizi is home to CIMERWA Cement, which is Rwanda's largest cement producer: high quality local limestone deposits make Rusizi the ideal location for cement production. Also, there are a number of resource-based manufacturers that produce Rusizi's top goods: furniture, coffee, fruits and vegetables, fishing and rice. Also, Rusizi has

underexploited potential in tourism: its strategic location by Lake Kivu, where maritime connection to the other secondary city, Rubavu, can further influence Rusizi's development, as can its close proximity to the Nyungwe National Forest.

7.6.2 Potentialities

Trade and experiences with DRC

Currently, Rusizi is experiencing high volumes of cross border trade with the DRC. There are experienced traders, strong transport infrastructure for transportation of goods, and high demand from Bukavu for agricultural goods in Rusizi. There are facilitating measures in place such as: the existing private investment in cross border trade; the existence of strong financial institutions; and the establishment of ICT infrastructure. However, there is a limited cooperative capacity to engage in cross-border trade; limited business development skills in order to become more regionally competitive; poor food manufacturing techniques for trading; and there are high levels of tax evasion.

Tourism

The main touristic site in Rusizi is Nyungwe Rainforest, which offers the possibility of many types of hikes and it already has the renowned best hotel in Rwanda: Nyungwe Lodge. Rusizi is located at one of the furthest places from Kigali, which by road takes approximately 6 hours, however, by air; it only takes 45 minutes, where there are already established daily flights to and from Kigali through Rwandair. The presence of Lake Kivu also plays a role in attracting tourism. However, there are high start up costs to generating further hospitality services; there are limited languages skills; a lack of basic infrastructure set out.

Maritime Transport

The presence of Lake Kivu sets Rusizi in a strategic place for further development. The main advantage is that of maritime transport, where it has direct connections to the DRC as well as other districts within Rwanda including other secondary cities: Karongi, Nyamasheke, Rutsiro and Rubavu respectively. The main uses of maritime transport are to export and import goods along with migration of people. However, there are constraints that deter this potentiality from fully being developed. Constraints

include the lack of local skilled manpower; insufficient investment in port construction; lack of modern ships; insufficient technicians for maritime transportation and ship construction; and the fact that there is competition against road transport means.

7.6.3 Branding concept for Rusizi: The Western Gateway for Trade and Tourism

City branding is the promotion of a city with the aim of encouraging certain activities to take place there. It is used to alter the external perceptions of a city in order to encourage private and public investment, tourism, attract inward migration, or enable business relocation. Based on its urban context and its potentialities, the specific branding to be developed for Rusizi should be based on the concept of the city being the **Western Gateway for Trade and Tourism**.

7.6.4 Local economic clusters to prioritize

Considering the proposed branding concept and the potentialities, the following economic clusters should be developed in the secondary city of Rusizi:

- Logistics and transport (road and maritime, shipbuilding, airport development)
- Tourism (international and national, high-end ecotourism)
- Agribusiness (rice, fishing, and fruits and vegetables)
- Mining (gold and peat)
- Financial services and cross-border trade

7.6.5 Accelerating growth in Rusizi

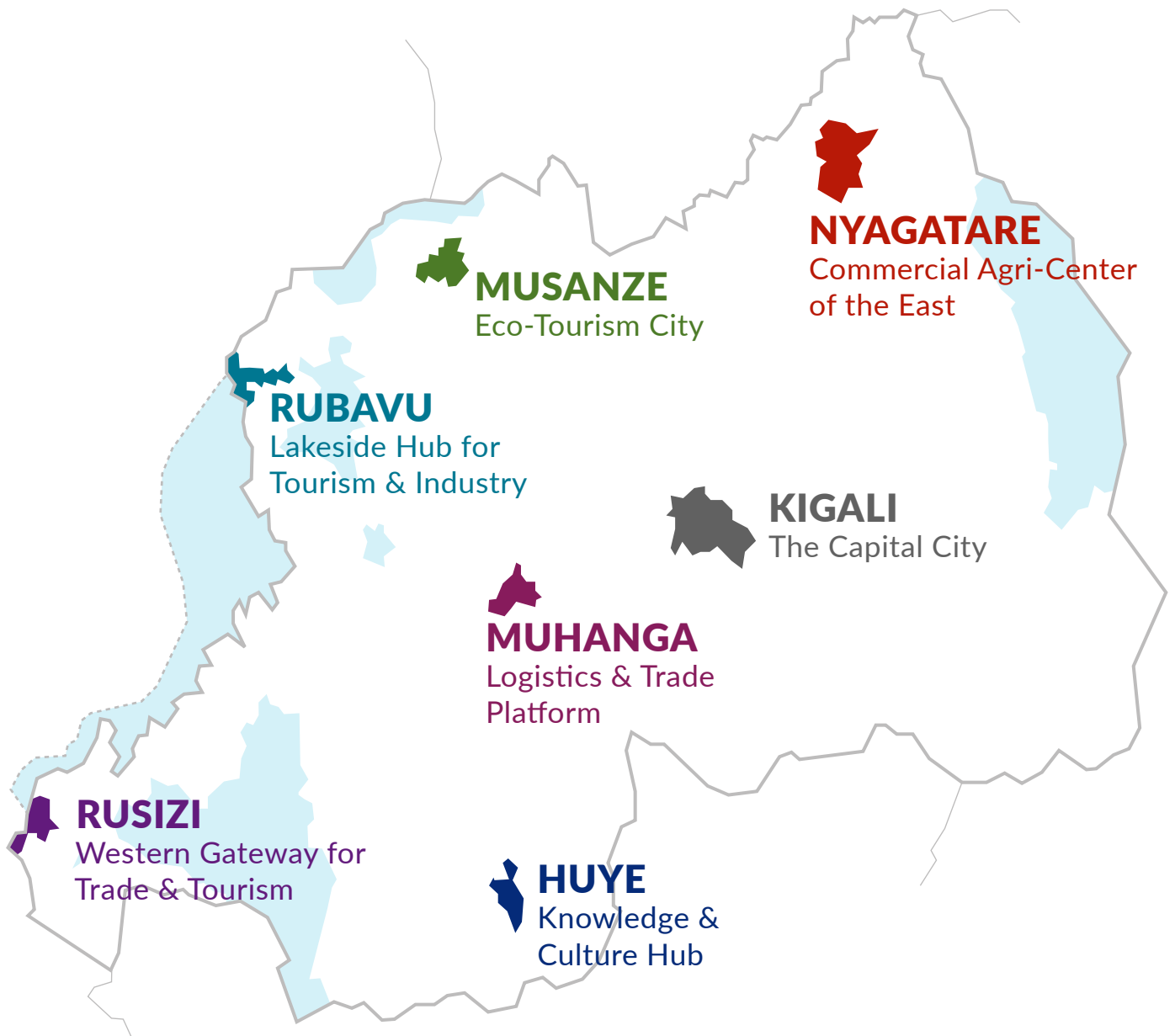
Accelerating growth requires concerted government action. Action on infrastructure, equipment and social programs must generate positive outputs and - ideally - be associated a multiplier effect.

Based on the prospective local clusters identified for Rusizi, the following actions should be prioritized:

- Development of basic infrastructure: water for all, access to sanitation, access to electricity
- Development of the road network

- Development of infrastructure for logistics and trade with DRC and Burundi
- Development of new tourist attractions and tourism infrastructure (hotel, tourism board, etc.)
- Development of the shipbuilding industry
- Development of a waste management plan and improvement of the waste management facility
- Development of a sanitation strategy (in order to transform and reuse the sludge as energy for the industry)
- Development of the industrial park and attraction of businesses

Moreover, local actions which are common to the six secondary city districts are listed at the action plan of the NR.





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8. Implementation and monitoring

A strategic and coherent implementation process is the key to a successful project. Therefore, the development of the secondary cities must be sustained with tangible actions and substantial investments in infrastructure.

The green strategies and guidelines for the foundations, pillars and pull factors of green urbanization were presented in the NR. They represent the conceptual framework for the action plan in the investment strategy, where following the adoption of the NR, an investment strategy will be developed as part of a larger implementation program of the GoR in collaboration with the World Bank and other investors.

The investment strategy will provide general criteria for investment decisions that includes considerations of the multiplier from investment returns, cost effectiveness and efficiency of an investment, compatibility with economic growth, win-win solutions, technology, and pricing and charges.

In addition, the second section provides a monitoring framework for green urban development in order to evaluate the implementation, progress and achievements of actions. Monitoring the level of green development of secondary cities is also a way to highlight successful domestic practices that could be replicated in another secondary city or even in other development countries that have similar characteristics.

8.1 Criteria for investment decision

Decision-making in the public sector to provide public goods to the economy is complex and has many constraints such as scarce resources and the continuation of compensating the prior misallocation of resources. Green growth includes many components that are categorized as public goods that also present long-term benefits. Therefore it is crucial that public investments are strategic in order to achieve development goals. This requires considerations in the following areas:

8.1.1 Cost-effectiveness and efficiency of investment

Whether a public investment is deemed cost effective or efficient depends on the process of investment appraisal.

One of the most prominent and widely used analytical and quantitative tool for decision making (investment appraisal) in the public sector is Cost-Benefit-Analysis (CBA). It is used: to assess and evaluate the proposed resource allocation; to determine the desirability of project investment especially when it is important to take into account the long-term view; and to compare different projects, thus choosing the most promising one.

The methodology includes the following process: (i) identification of all affected entities from investment (consumers, non consumers, externality effect and other social benefits or costs); (ii) putting monetary values (positive or negative) to all listed entities as costs and benefits; (iii) adjust for time-value of money (discount rate); (iv) calculate the net-present value (NPV), which is the sum of discounted incoming and outgoing future cash flows; and (v) comparison of the total values of the costs and benefits, where if the benefits outweigh the costs, then the government should proceed with the public investment.

Due to the green aspects of decision making that this NR presents, it poses further difficulties in decision making in regard to putting monetary values on non-financial welfare impacts such as human life and the environment. Other constraints include difficulties related to the following: ensure that all affected entities are taken into account; take into account distributional consequences; measure welfare, as social welfare is not the same as individual welfare; and to choose a relevant time period for the NPV and discount rate because some benefits are immediate but other benefits are delayed and over a long time horizon. This is deemed especially difficult in Rwanda as the planning process is based on limited experience and there is an overall lack of data to effectively calculate CBA as efficiently as possible, especially considering that the calculations for human or environmental welfare are based on many uncertainties.

CBA is a tool that focuses on the economic efficiency aspects of government decision-making, where with a promising and favourable investment the public sector is able to efficiently allocate the scarce resources. Using investment priorities towards the secondary cities serves an additional strategic factor in regard to spreading welfare gains throughout Rwanda: it will directly affect economic development, quality of life and opportunity for the public at large.

8.1.2 Multiplier effect of investment

In a context of limited financial resources and budgetary constraints, whenever possible, a government has to focus on how to maximize the value of outputs derived from its investments.

For example, if the GoR invests in financially viable infrastructure projects, then it should be possible for the capital to be returned and reinvested in new infrastructure projects, thereby maximizing the impact of public sector money. To make it possible, the GoR needs to invest first in projects with projects with independent revenue streams (such as energy production or utilities that are associated with user charges). Also, an infrastructure project should be financially viable to amortize capital and generate a return (both to the private or the public sector investors, as applicable).

This can be done through various methods such as through public private partnerships (PPPs), where various responsibilities (financing, implementing and managing) are shared and leveraging government funds with private sector investment, through the efficiency dividend that private sector involvement can bring in project delivery and management and through strategic models that makes the functionality of a services self sustainable such as from the ability to acquire finance that can pay for the services' maintenance. from maximizing the ability to earn a return on (or a return of) their the investment to enable capital to be recycled into future projects. The multiplier of the investment returns. In general, the fiscal multiplier of infrastructure spending is much larger than the typical government spending multiplier¹⁶. Therefore, infrastructure investments offer value in terms of job

creation and return-on-investment through taxation. This should be taken into account in investment prioritization.

8.1.3 Compatibility with economic growth objectives

Investment to meet infrastructure gaps along with greening the infrastructure sector need to be compatible and reinforce economic growth and inclusion objectives. In Rwanda, economic growth will: generate jobs, improve living conditions and availability of services, and contribute to decreasing inequality. Investment in infrastructure in secondary cities should be clear and informative (in terms of legal rights, costs and benefits, and intended outcomes of plans) to both the local citizen and the potential urban dweller. This will: increase local government credibility; grow citizens' confidence to themselves invest; and enable and encourage the citizen to increase their rates of savings. All in all, government investments give leeway to further investments within society that contribute to economic growth.

8.1.4 Win-Win Solutions

Investment in the pillars of urbanization should be profitable to many actors involved in a secondary city development process. This is particularly important with regard to land density, urban mobility, and energy. For example, generally speaking, sprawl has a negative impact on sustainable growth. However, controlled and well-managed sprawl could be a win-win solution in some cases: It is profitable for developers (who can make profit from real estate), construction workers (who can get jobs), households (who can afford land and housing at a lower price) and local administration (by extending its tax-base). Therefore, investment selection should take into account externalities and provide a maximum of win-win solutions.

8.1.5 Technology

Increasing access to technology through investment in a city is not a basic human need but it increases efficiency of goods and services, economic productivity, communications, global competitiveness, improves amenities and overall maximizes the attractiveness of a city. Therefore investment in technology offers multiplier

16 LEDUC, Sylvain. WILSON, Daniel. Highway Grants: Roads to Prosperity? Federal Reserve Bank of San Francisco Economic Letter. San Francisco, 2012.

effects and can generate higher revenue streams. In addition, enabling the use of networks improves the capacity of the city to respond to emergency situations and helps to provide a secure environment for investment.

8.1.6 Pricing and charges

When possible, development of infrastructure should be accompanied by the implementation of a coherent pricing scheme. Prices need to reflect the environmental costs, as it would limit overuse or negative externalities. Pricing generates a revenue stream for the authority or the private operator of a service and also guides the level of household consumption and can help to minimize pollution associated from inefficient over consumption. Notably, in the urban transport sector a coherent, comprehensive and evaluative pricing strategy for bus, fuel, and vehicle registration could help to prevent or manage congestion and pollution in a city.

8.2 Monitoring green urban development

The NR provides guidelines for green secondary city development. However, monitoring implementation progress and achievement of targets is strategic and provides guidance for the future. Also, monitoring the level of green development of secondary cities is a way to **highlight good practices that could be replicated** from one successful secondary city to another.

In order to monitor the green growth performance of secondary cities it is important to have a commonly agreed analytic tool. Therefore, GGGI developed a **Green Performance Index (GPI)** based on key performance indicators (KPI) for monitoring the growth of cities and their respective sustainability levels. Based on the **African Green City Index**¹⁷ – a research project conducted by **The Economist Intelligence Unit** and sponsored by the company **Siemens** – the GPI is a tool that should be used on a regular basis in order to identify infrastructure or

policy areas that should be improved in a secondary city in order to improve its sustainability. Therefore, an initial GPI reflecting the current status of secondary cities should be provided after the adoption of the NR. This first KPI will provide an analysis of the current context and will guide the prospective investments within a green development framework.

In the short, medium and long term, the GPI will contribute to measure and assess the respective performance of secondary cities across a wide range of green indicators. For the future, it is also a way to highlight green policies and projects that other secondary cities and other cities could learn from.

For each city the GPI provides **26 key performance indicators** based on multiple data that are grouped in nine categories. The analysis associated to the GPI is transparent, consistent and replicable, and could reveal sources of best practice. Indicators are based on data available from different sources (Population and Housing Census, Integrated Household Living Condition Survey, GoR ministerial data, etc.).

Eleven of the 26 performance indicators are qualitative assessments of each city's policies, regulations and ambitions – for example, its commitment to reducing the environmental impact of energy consumption, developing green spaces and conservation areas, improving urban transport or recycling waste. Data limitations mean that the GPI relies on qualitative assessments of policies. Policies indicate commitments to reduce environmental impacts and therefore, the indicators are weighted more toward an assessment of a city's potential future environmental performance than existing condition.

8.2.1 Methodology

The **African Green City Index** developed by **The Economist Intelligence Unit** inspired the preparation of GGGI's GPI. Adapted to the Rwandan context the GPI is a tool to measure the current and future performance of secondary cities and their commitment to green growth and sustainable development.

Based on key performance indicators the GPI is a tool scoring urban areas across nine categories – urban planning, building, energy, green economy, urban mobility, water, sanitation, waste, and governance – and

17 The Economist Intelligence Unit. African Green City Index – Assessing the environmental performance of Africa's major cities. Munich, 2011.

is composed of 26 individual key performance indicators. Fifteen indicators are based on quantitative data and aim to measure how a city currently performs – for example the proportion of the population with access to potable water, its level of CO₂ emissions from electricity consumption, the level of waste production, or the access to sanitation. The other eleven indicators are a qualitative assessment of each city's policies, regulations and ambitions – for example the commitment to developing green spaces and conservation areas, improving mass transport, or providing recycling waste services.

The data required to measure the performance of a city will be taken from publicly available official sources, such as the **National Institute of Statistics Rwanda**, districts and **One-Stop-Centres**, **WASAC**, utilities companies, and ministries and agencies (**MININFRA**, **MINECOFIN**, **MINALOC**, **MINRENA**, **REMA**, **RHA**, **RDTA**, **RNRA**, etc.).

Some indicators are currently not available or the data is not collected at the urban area level. In these cases, the table indicates that data collection will be required. One of the actions of the NR recommends a revision of the national census methodology in order to collect economic and social data at the sector level (and consequently at the secondary city level instead of the district level alone).

Scoring of indicators

In order to compare data across cities and to calculate aggregate scores for each city, the data gathered from various sources had to be made comparable. For this purpose the quantitative indicators have to be “normalized” on a scale of zero to ten, with the best city scoring ten points and the worst scoring zero.

An independent party should undertake measure of qualitative indicators. Therefore, we suggest this work to be done by GGGI analysts with expertise in the city in question, based on objective scoring criteria that consider cities' targets, strategies and concrete actions. The qualitative indicators should be scored on a scale of zero to ten, with ten points assigned to cities that meet the criteria on the checklist.

Performance Index

The aggregation of the scores of all indicators provides the Green City Performance Index. It is first aggregated by category – creating a score for each area – and finally, overall, based on the weight and total of the category scores. To create the category scores, each underlying indicator is aggregated according to an assigned weighting.

The category scores are then rebased onto a scale of zero to 100. To build the overall green secondary cities index scores, GGGI assigned weightings to each category score; because of its comprehensive nature urban planning has a greater importance (20%) than any other.

The operationalization of the **Green City Performance Index** will take place following the technical validation of the NR. The quality of available data will affect the index. The following pages show the indicators selected to develop the index.

GREEN SECONDARY CITIES INDEX - KEY PERFORMANCE INDICATORS (KPI)

Category	Indicator	Type	Weight	Description	Normalization techniques	
A Urban Planning 20%	A1	Urban population density	Quantitative	25%	Persons per km ² (data for sectors within urban areas is required)	Zero-Max
	A2	Population living in informal settlements	Quantitative	25%	Percentage of the population living in informal settlements (data for sectors within urban areas is required)	Zero-Max (Less is best-negative indicator)
	A3	Green space per capita	Quantitative	25%	Sum of all public parks, recreation areas, and other protected areas accessible to the public, in m ² per inhabitant	Zero-Max
	A4	Local land development plan	Qualitative	25%	Measure of a secondary city's effort to minimize the ecological impact of urban development	Scored by GGGI analyst on scale of 0 to 10
B Building 10%	B1	One-Stop-Centre capacity to provide guidance on green building design and construction	Quantitative	34%	Proportion of the staff that attended at least two capacity building training sessions on green building design and construction technologies in the last year	Zero-Max
	B2	Permit facilitation process for projects featuring green technologies	Qualitative	33%	Adoption of a permitting facilitation procedure (lower permit cost, etc.) bthe One-Stop-Centre for projects integrating green building technologies as defined by the NR	Scored by GGGI analyst on scale of 0 to 10
	B3	Public green building construction by the district or the GoR	Qualitative	33%	Proportion of green buildings that were built or renovated by the district or the GoR in the last year in the secondary city (vs. the total of new public buildings)	Zero-Max
C Energy 10%	C1	Access to electricity	Quantitative	34 %	Percentage of households with access to electricity (data for sectors within urban areas is required)	Min-Max
	C2	Electricity consumption per capita	Quantitative	33 %	Total electricity consumption, in GJ per inhabitant (1 GJ = 277.8 kWh)	Zero-Max
	C3	CO ₂ emissions from households per capita	Quantitative	33 %	CO ₂ emissions, in kg per capita	Zero-Max
D Green economy 10%	D1	Rate of unemployment	Quantitative	34 %	Percentage of the population without a job (date for sectors within urban areas is required)	Min-Max
	D2	Rate of green employment (green jobs)	Quantitative	33 %	Percentage of the working population employed in a green industry as defined by the national Roadmap (data for sectors within urban areas is required)	Min-Max
	D3	Local green jobs development strategy	Qualitative	33 %	Measure of a secondary city's effort to create green economic opportunities for the population	Scored by GGGI analyst on a scale of 0 to 10
E Urban Mobility 10%	E1	Public transport network	Quantitative	66 %	Length of mass transport network, in km per km ² of city area	Zero-Max
	E2	Urban transport plan	Qualitative	34 %	Measure of a city's effort to create a viable mass transport system as an alternative to private vehicles	Scored by GGGI analyst on a scale of 0 to 10

National Roadmap for Green Secondary City Development

GREEN SECONDARY CITIES INDEX - KEY PERFORMANCE INDICATORS (KPI)						
Category	Indicator	Type	Weight	Description	Normalization techniques	
F Water 10%	F1	Access to potable water	Quantitative	25 %	Proportion of the population with access to potable water (data for sectors within urban areas is required)	Min-Max
	F2	Water consumption per capita	Quantitative	25 %	Total water consumption, in litres per person per day (data for sectors within urban areas is required)	Min-Max; • 20-100l/capita/day = full point; • Less than 20l/capita/day = zero point (below UN standard)
	F3	Water system leakages	Quantitative	25 %	Share of water lost in transmission between supplier and end-user, expressed in terms of total water supplied	Zero-Max
	F4	Local water sustainability plan	Qualitative	25 %	Measure of a city's effort toward improving the quality of surface water	Scored by GGGI analyst on a scale of 0 to 10
G Sanitation 10%	G1	Population with access to improved sanitation	Quantitative	66 %	Share of the total population either with direct connection to sewerage, connected to treatment system, or with an individual sustainable sanitation solution (data for sectors within urban areas is required)	Min-Max
	G2	Local sanitation plan	Qualitative	34 %	Measure of a city's effort to reduce pollution associated with inadequate sanitation	Scored by GGGI analyst on a scale of 0 to 10
H Waste 10%	H1	Waste generated per capita	Quantitative	34 %	Total annual volume of waste disposed in a landfill (excluding recycling and reuse), in kg per capita per year	Zero-Max (negative indicator)
	H2	Waste collection plan or policy	Qualitative	33 %	Measure of a city's effort to improve its waste collection and disposal system to minimize the environmental impact of waste	Scored by GGGI analyst on a scale of 0 to 10
	H3	Waste recycling plan or policy	Qualitative	33 %	Measure of a city's effort to reduce, recycle and re-use waste	Scored by GGGI analyst on a scale of 0 to 10
I Governance 10%	I1	Environmental monitoring	Qualitative	66 %	Measure of the city's effort to monitor its environmental performance	Scored by GGGI analyst on a scale of 0 to 10
	I2	Public participation	Qualitative	34 %	Measure of the city's effort to involve the public in environmental decision making	Scored by GGGI analyst on a scale of 0 to 10



8.3 Action plans

To mainstream the foundations, pillars and pull-factors of green urbanization, the NR proposes tangible actions.

These were developed in alignment with the proposed green guidelines and green strategies of the NR. The national and local government are the main entities to lead the implementation of these actions.

In addition, to help with the implementation phase of the proposed actions of the NR, GGGI in direct collaboration with **MININFRA**, will produce an **Investment Program** and a **Capacity Building Program**.

Secondary Cities bring about a wide variety of different potentialities, which means the cities can spur further economic growth if they are developed correctly and ideally in a green fashion.

The right infrastructure serves the city with a good physical base in order to take advantage of its potentialities and therefore add value to the economy.

NATIONAL ACTIONS ROLES AND RESPONSIBILITIES		Academic Sector	Capacity Building Sec.	Districts	FONERWA	MIDIMAR	MINAGRI	MIFOTRA	MINALOC	MINECOFIN	MINEDUC / INISANTE	MINICOM	MININFRA	MIGEPROF	NISR	Private Sector	REG (MININFRA)	REMA (MINERENA)	RGB	RHA (MININFRA)	RNRA	RURA	RPPA	RTDA (MININFRA)	WASAC (MININFRA)
		1	Affirm the existing status of secondary city districts, their roles and their responsibilities based on EDPRS 2																						
2	Prioritize national investment in strategic infrastructures of secondary cities.																								
3	Promote the development a Secondary Cities Committee (SCC) within RALGA. The SCC will develop activities and a knowledge exchange platform between the six secondary city districts.																								
4	Implement a coaching program targeting OSC staff of secondary city districts.																								
5	Develop a permanent capacity building program for staff of ministries and secondary city districts targeting the strategies and guidelines of the NR.																								
6	Revise the statistical framework in order to define the urban boundaries of secondary cities as data collection areas for the next Integrated Household Living Conditions Survey (EICV) and the Population and Housing Census (PHC).																								
7	Mainstream secondary city level data through NISR reports, and GoR policies and strategies (when updating).																								
8	Disseminate and explain the strategies and the guidelines of the NR in order to integrate them in the next revision of the MPLMUP and LLDP of secondary city districts.																								
9	Validate the compliance of revised MPLMUP and LLDP of secondary city districts with the strategies and the guidelines of the NR.																								

National Roadmap for Green Secondary City Development

NATIONAL ACTIONS ROLES AND RESPONSIBILITIES		Academic Sector	Capacity Building Sec.	Districts	FONERWA	MIDIMAR	MINAGRI	MIFOTRA	MINALOC	MINECOFIN	MINEDUC / INISANTE	MINICOM	MININFRA	MIGEPROF	NISR	Private Sector	REG (MININFRA)	REMA (MINERENA)	RGB	RHA (MININFRA)	RNRA	RURA	RPPA	RTDA (MININFRA)	WASAC (MININFRA)
10	Develop national guidelines for green streets and mainstream it toward OSC staff of secondary city districts.																								
11	Develop and disseminate a national training program on mainstreaming gender perspective in urban planning and city development.																								
12	In collaboration with OSC staff, develop a resilience and disaster risk reduction strategy for secondary cities.																								
13	Develop national guidelines for resilient infrastructure and mainstream it toward OSC staff of secondary city districts.																								
14	Finalize and mainstream the 'Green Building Practice Guide' toward OSC staff of secondary city districts through a specific capacity building program.																								
15	Disseminate the results of the 'Building Materials and Housing Affordability Workshop' (2013) toward the real estate industry.																								
16	Conduct a market assessment of Rwanda's volcanic rocks for potential use as a construction material.																								
17	Ensure successful rollout of the Green Buildings Calculator developed by Rapid Planning for the real estate industry.																								

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18	In collaboration with academics and real estate professionals, partner with a foreign Green Building Council and leverage their support to develop and implement a Rwandan green building certification system.																								
19	Support the implementation of the Action Agenda of SE4ALL.																								
20	Mainstream the Action Agenda of SE4ALL toward OSC staff of secondary city districts.																								
21	Conduct a study to explore strategic methods of promoting LEDs.																								
22	Identify mini-hydro potential around the secondary cities and clearly outline the possibilities and constraints for potential investors.																								
23	Conduct a market assessment for Solar PV and Solar Water Heaters in secondary cities to promote and attract investments along with expertise.																								
24	Conduct a market assessment of the multiple improved cookstoves - to strategically support the most efficient, and find affordability solutions, and develop a subsidy strategy in order to encourage the use of improved cookstoves by low and medium income households in secondary cities.																								

National Roadmap for Green Secondary City Development

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25	Mainstream the National Forest Inventory to the NAFA stations, prioritizing the secondary cities by efficient capacity building on improved management.																								
26	Support the development of local sustainable mobility strategies through capacity building and provision of Nnational-level expertise.																								
27	Conduct a market assessment on public transport system within secondary cities - for further knowledge on how to increase private sector involvement and adopt technologies.																								
28	Set national standards on public transport performance																								
29	Define national standards with regard to road planning (width, sidewalks, bike-path, bus lane, etc.) in the UPC																								
30	Support the development of local water resource management framework through capacity building and provision of national-level expertise.																								
31	Plan and develop a pilot green water treatment plant in a secondary city.																								
32	Implement a 'Zero energy water purifiers' program targeting low-income households in order to maximize the carbon offset of Rwanda.																								

NATIONAL ACTIONS ROLES AND RESPONSIBILITIES		Academic Sector	Capacity Building Sec.	Districts	FONERWA	MIDIMAR	MINAGRI	MIFOTRA	MINALOC	MINECOFIN	MINEDUC / INISANTE	MINICOM	MININFRA	MIGEPROF	NISR	Private Sector	REG (MININFRA)	REMA (MINERENA)	RGB	RHA (MININFRA)	RNRA	RURA	RPPA	RTDA (MININFRA)	WASAC (MININFRA)
33	Implement a Water Loss Reduction program in order to identify non-revenue water and upgrade existing networks. Non-revenue water should not represent more than 20% of total water distributed.																								
34	34 Develop standard for the construction of underground pipes based on the use of locally available sustainable materials and promote heat fused connections of pipes.																								
35	Identify large water users and polluters and develop in collaboration with academics and industries new production techniques such as water recycling																								
36	Support the development of local sanitation strategies through capacity building and provision of national-level expertise.																								
37	Plan and develop a pilot sludge stabilization and reuse facility (planted drying bed) in a secondary city.																								
38	Conduct a market assessment on reuse of stabilized sludge as energy or fertilizer for agriculture in secondary city districts.																								
39	Support the development of local waste management plan through capacity building and provision of national-level expertise.																								
40	Conduct a market assessment on waste disposals including composting and recycling materials in secondary cities.																								

National Roadmap for Green Secondary City Development

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41	Support the development of local sanitary landfills in each secondary city through capacity building and provision of national-level expertise.																								
42	Integrate the six secondary cities to the existing District Integrated Development Project of GoR in order to facilitate national investment in local economic development.																								
43	Follow the recommendation of the World Bank Feasibility study for infrastructure development in secondary cities in order to invest on the pillars of green urbanization																								
44	Develop an eco-industrial park concept for Rwanda based on global best practices and identify the development potential of such a concept in secondary cities.																								
45	Plan the development and the implementation of a pilot Eco industrial parks in a secondary city.																								
46	Develop a national curriculum and an apprentice program (Technical and Vocational Training) for mechanical maintenance of public transport vehicles (notably for vehicles complying with EURO 3 standard and above)																								
47	Promote the development of training and skills-building programs to successfully include women in the developing green economy.																								

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48	Disseminate success stories of businesses that have managed their transition toward a green economy by adapting their practices and means of production.																								
49	Assess the environmental impact of key export industries identified at the NIP in collaboration with the private sector.																								
50	Develop green technologies for key export industries identified at the NIP in collaboration with academics and the business community																								
51	Implement green procurement practices favouring green products and services for the GoR and its ministries.																								
52	Enforce laws and regulations to protect workers conditions in the green economy.																								
53	Prioritize national investment in order to raise educational and health facilities of secondary city districts to national standards.																								
54	Implement Early Childhood Development and Family Centre (ECDFC) in each secondary city and mainstream the benefits to local government and the public through capacity building and marketing campaigns respectively.																								

National Roadmap for Green Secondary City Development

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1	Mainstream the status, the role and the responsibilities of secondary city districts toward local decision-makers and OSC staff.																								
2	Participate proactively in the development of a knowledge exchange platform between the six secondary city districts.																								
3	Review new statistical data at the secondary city level for all planning works.																								
4	<p>Revise MPLMUP or LLDP in order to integrate (in addition to existing requirements) the following strategies and guidelines from the NR:</p> <ul style="list-style-type: none"> Define and anticipate land needs; Realize and environmental assessment of the urban area, identify valuable ecosystems, and provide protection measures. Identify opportunities to create a green belt and greenways in order to integrate nature within the urban environment. Plan green spaces within the urban area in order to meet a minimum standard of 15 m per person. Set density standards based on the local context. Set inclusive land use categories allowing mixed-use development and avoid mono functional urban expansion. Plan new neighborhoods so that an existing or planned bus route is always less than 400 meters or 5 minutes' walk away. Develop an urban mobility strategy (see local action 14). Develop a local water resource management framework (see local action 17). Develop a local sanitation strategy (see local action 21). Develop a local waste management plan (see local action 22). 																								

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5	Integrate a gender and youth perspective in the revision of the MPLMUP or LLDP through a consultation process with the district's representatives of the National Women Council.																								
6	Identify urban areas characterized by a safety issue and realize safety workshops on the ground with district technicians, security officials, women, young people and children, in order to identify direct actions for improvement.																								
7	Adopt a resilience and disaster risk reduction strategy and implement identified actions.																								
8	Apply responsible resettlement practices based on social and environmental safeguards, if resettlement is required.																								
9	Adapt the permit emission process of OSC in order to comply with the requirements of the Rwanda Building Code.																								
10	Disseminate the "Green Building Practice Guide" to local architects.																								
11	Develop a list of local suppliers in order to encourage the use of local construction material.																								
12	Disseminate the new "Rwandan green building certification system" to local architects and local real estate professionals.																								
13	Install solar energy street lamp in new urban neighborhoods and replace existing sodium HPS street lamps with LEDs																								
14	Conduct a local awareness campaign on the benefits of improved cooked stoves and methods of alternative energy sources such as liquefied petroleum gas (LPG).																								

National Roadmap for Green Secondary City Development

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15	Develop a local sustainable mobility strategy in the context of the revision of the MPLMUP or the LLDP (see local action 4) which include: Non-motorized mobility plan. Plan for the implementation of a public transport system. Road network hierarchy based on UPC standards and investment priorities. Action plan for implementation.																								
16	Incorporate the standards of the UPC with regard to pedestrian traffic management in the construction of any new road.																								
17	Prioritize road investment based on the road hierarchy defined in the local sustainable mobility strategy.																								
18	Develop a local water resource management framework in the context of the revision of the MPLMUP or the LLDP (see local action 4) which include: Delimitation of the drinking water source protection areas. Inventory of sources of contamination within the protection areas. Identification of measures to prevent, reduce or eliminate threats to water source. Identification of areas to be served by a public water network Identification of existing or prospective water points (within 200 m of any new household). Action plan for implementation.																								
19	Provide improved lighting for all water points in order to maximize security.																								
20	Develop the underground pipes network based on the standards developed at the national level.																								

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21	Require the installation of a rainwater harvesting system at permitting. In accordance with the Building Code and RS 187, all new building shall be provided with a rainwater harvesting system.																								
22	Develop a local sanitation strategy in the context of the revision of the MPLMUP or the LLDP (see local action 4) which include: Definition of the current status with regard to sanitation. Identification of sanitation priorities. Sanitation system development strategy. Collection strategy. Identification of opportunities for reuse of sludge, including for energy generation or fertilizer for agriculture. Identification of infrastructure needed for safe sludge disposal. Action plan for implementation.																								
23	Develop a local waste management plan in the context of the revision of the MPLMUP or the LLDP (see local action 4) which include: Analysis of the current situation. Analysis of quantity and type of waste generated by the various sources. Identification of opportunities of waste uses including recycling, reusing of non-recycling materials, composting, and potential reuse for energy generation. Definition of services, infrastructure, and implementation measures. Identification of strategic targets and indicators. Action plan for implementation.																								
24	Conduct a local awareness campaign for the minimization of waste produced by middle and high-income households.																								
25	Develop and implement a dual collection system in middle and high-income neighborhoods in order to facilitate the valorization of waste.																								

National Roadmap for Green Secondary City Development

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26	In accordance with the UPC, implement waste disposal collection site in low-income areas, at a maximum distance of 250 meters of any household.																								
27	In accordance with the provisions of the local waste management plan (see local action 22) develop a large scale recycling site.																								
28	Design and construct a sanitary landfill in accordance with RURA standards.																								
29	Based on the economic development potentialities identified in LODA's report and the guidelines of the NIP, implement a local economic development strategy promoting the development of a green economy.																								
30	Adapt the training offered by local Technical and Vocational Training Centres in order to provide the skills needed by businesses in the niche sectors identified at the local economic development strategy.																								
31	Mainstream the practices, programs and/or incentives to the local private sector and public through capacity building and increased awareness of potential cost-effective green entrepreneurship methods.																								



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