DETAILED DISTRICT PHYSICAL PLANS KICUKIRO & GASABO KICUKIRO & GASABO

KIGALI CITY ANALYSIS, BENCHMARKING & VISION REPORT MAY 2013

TASK ORDER 2: ANALYSIS AND VISIONING



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PREFACE

PROJECT BACKGROUND

The City of Kigali (CoK), one of the most active and progressive City Councils of Africa, aspires to see Kigali develop as a competitive, safe and clean modern city. In the recent past, the Government of Rwanda has undertaken the preparation of several urban development plans in the sectors of planning, transport, infrastructure, housing and environment for Kigali. Having completed the Kigali Conceptual Master Plan (2008) and Detailed Master Plans for Nyarugenge District as well as various other sub-areas of Kigali, the City now intends to develop Detailed Physical Plans for the other two Districts, namely, Gasabo and Kicukiro, so as to have an integrated detailed plan for the entire City.

PROJECT COMMISSIONING AND SCOPE

In early 2010, Surbana International Consultants, Singapore (Surbana) completed the Detailed Planning of Nyarugenge District, which included Detailed Urban Design for Kigali's CBD. In October 2011, through a public tender, the City of Kigali awarded the **'Design of Detailed District Physical Plans for Kicukiro** & Gasabo' to Surbana.

This master planning project, in addition to the detailed planning of the two districts, has the following objectives:

- To review the planning direction and strategies for the entire City of Kigali, while integrating all the past planning and development initiatives undertaken.
- To prepare detailed master plan, urban design (for key areas) and development control guidelines for the two districts of Kigali, namely Gasabo & Kicukiro. This would also include the review and

revision of the Detailed Master Plan for Nyarugenge District, and integrating with plans for the Kicukiro and Gasabo Districts, so as to make available a complete city wide master plan for the whole of Kigali.

- To establish a GIS database for the entire City which has a coordinated base map, proposed land use plan & development control information for all areas of the City. This GIS system would form a part of the MIS system being put in place by the Government.
- To ensure participation of the various stakeholders in the development of the Master Plan so as to develop a plan that reflects the needs and aspirations of the City's residents.
- To ensure participation in the planning process as well as capacity building of the CoK staff through training programmes in Singapore and the local project office in Kigali.

PROJECT ORGANIZATION & SCHEDULE

The project is spread over one year and comprises of the following 6 task orders, each with a duration of 2-4 months:

Task Order 1:Start-up, Reconnaissance& Base-mapping

Task Order 2: Vision	Existing	Conditions	&
Task Order 3:	Conceptu	al District Pla	in
Task Order 4:	Schematic District Plans		
Task Order 5:	Detailed Urban Design		
Task Order 6:	Impleme	ntation Plans	

PROJECT PROCESS

In line with the project scope discussed above, the process to be adopted for this project is as elaborated below:

- Establishment of a proper working base which incorporates all land use related information for developing the master plan.
- In-depth analysis of various existing issues facing the City and stock-taking and review of previous master plans and infrastructure planning initiative in the City in order to develop an integrated plan.
- Establishing the strategic Urban Sustainability Framework for Kigali, that will become the overarching framework, guiding the City to address its key economic, social & environmental issues.
- Benchmarking with international best practices in city planning and management, determining the future growth scenario, and setting the development vision and the strategic growth direction for the city.
- Development of a conceptual transport plan, infrastructure plan & environmental management strategy for the entire city followed by detailed integrated master plans, transport & infrastructure plan and urban design plans for two districts.
- Mapping out implementation process to help realize the proposal, which includes development control guidelines.
- Putting in place an integrated landuse data management system which incorporates the base map, the Master plan and planning approval process.

The planning project adopted for this project is further in the illustration.



* Includes up Plan for Ny	dation of Base Map arugenge District	& review of Zoning
LEGEND:		
Task Order 1:	Project Start-up, Re	conn., & Base-Map
Task Order 2:	Extg. Conditions, O	pps & Cons Analysi
Task Order 3:	Conceptual Plan	
Task Order 4:	Schematic Plan	
Task Order 5:	Detailed Town Cent	tre Urban Design
Trabodiero	Implementation M	echanisms

PROJECT DELIVERABLE

Various reports, corresponding to the various task orders are to be submitted, which include:

Task Order 1:

Inception Report

Task Order 2:

 Analysis, benchmarking and Visioning Report

Task Order 3:

- Conceptual Kigali Transportation & Infra report
- Gasabo Conceptual Plan report
- Kicukiro Conceptual Plan report

Task Order 4:

- Final Transportation & Infra Master Plan report
- Final Gasabo Master Plan report
- Final Kicukiro Master Plan report
- Gasabo Zoning booklet
- Kicukiro Zoning booklet

Task Order 5:

- •Gasabo Town Centre Urban Design report
- Kicukiro Town Centre Urban Design report
- Gasabo Town Centre Zoning booklet
- Kicukiro Town Centre Zoning booklet

Task Order 6:

Implementation report

In addition to this, various marketing and promotional materials to illustrate the master plan would be prepared at the time of the public exhibition.

A Geodatabase, incorporating the existing land use map, the proposed land use plan & the development control information would be submitted at the completion of the project.

STAKEHOLDERS' PARTICIPATION & CAPACITY BUILDING

A key component of the project would be to ensure adequate participation in the planning process from various stakeholders such as decision-makers, private sector focus group, community organization and various public interest groups. As such numerous meetings, seminars and workshops are to be undertaken at all stages of the project. A long-term public exhibition of the master planning project is to be undertaken at the end of the project with an objective to launch and market the master plan.

In addition a communication plan, executed through various print, broadcasting & online media would ensure participation and feedback from the wider public. This plan preparation process would also be an opportunity for capacity building of CoK staff, so as to enable the in-house team of CoK to develop into a capable planning office for the country.

This comprehensive city wide plan, incorporating the detailed plans of the two districts as well as all the past planning initiatives would become the long term development framework for Kigali City guiding it into an era of progressive and holistic city development.

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GOVERNMENT AUTHORITIES

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KICUKIRO DISTRICT

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EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

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THE REPUBLIC OF RWANDA is at a critical cross-roads. It's visionary leadership is rapidly helping transform the country form a low scale agrarian economy to an active player within regional economy. In these very exciting times, Kigali is the centre of transformation in Rwanda and is on the threshold of rapid economic growth. With one of Africa's most progressive leadership and governance, this young and energetic city aspires to provide the platform for Rwanda's new identity in the Africa and beyond.

While it is on this progressive trajectory, it is also experiencing urbanization and social pressures as never before. The

URBAN SUSTAINABILITY FRAMEWORK (USF)

The Urban Sustainability framework sets the development framework for Kigali to guide its future growth. It lays down the key issues and development strategies which would guide the preparation of the masterplan.

government recognizes the need that

success should be accompanied with social

equity and environmental balance. There

is no better time than now to take stock

of current development trends and future

growth outlook and device a masterplan

which would help the capital city to achieve

its growth potential. This project is such

an attempt which will ensure a detailed

physical plan to the entire city to guide and

direct the development. With commitment

and a steady course, the Kigali City

masterplan will achieve this harmony which could catapult Kigali to become a major

African centre in the coming days.



	KEY ISSUES	DIRECTION	
ECONOMY Employment	 Lack of well-serviced attractive areas for investment Need for more employment opportunities for the increased natural and migrant population. 	 Create dedicated areas for businesses and regional commercial activities Job creation 	 Anticipate Safeguard (CBD /com JOB CREATION II 2012: 0.56 2025: 1.36 Year X: 2.3
SOCIETY LIVING CONDITIONS	Large disparity in quality of living environment between the rich and the commoner (majority)	Provide good quality affordable housing for all	 Create vari Ensure impand minim PROJECTED POP 2012: 1.22 2025: 2.88 Year X: 5.0
ENVIRONMENT Nature, Resources & Carbon Footprint	 NATURE AREA Urban areas prone to land slide Illegal developments on steep slopes Deforestation Encroachment of wetlands 	 Clearance of development in Steep Slopes and Wetlands Restoration of steep slopes & wetlands Acquire land for relocation of developments in steep slopes and wetlands 	 Conserve a Conserve a Prepare Repeople fro Prepare stimanagement
	 RESOURCES & CARBON FOOT- PRINT Sprawling low rise development Expanding urban areas Need for extended infrastructure / transportation facilities Increasing carbon footprint Increasing urban temperature 	Compact city development	 Limit urbai Identify pc Reduce spireduce infi Explore poto to counter

TARGETS

various investment possibilities land for economic expansion at key areas imercial centre, industrial areas, tourism spots)

N KIGALI:

5 million jobs 5 million jobs 33 million jobs

ious public housing/improvement schemes proved living quality for commoners nize the gap in terms of living quality.

PULATION:

- 2 million 3 million 07 million
- all slopes above 40% all wetlands edevelopment schemes to relocate
- om steep slopes & wetlands
- rategies for rehabilitation and for
- ent of slopes, forests and wetlands.

nization boundaries otential high density mixed use zones rawling development and hence, rastructure /transportation cost. ossibilities for further City greening r increase in carbon footprint. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

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The case of Kigali is unique. It has garnered global recognition for good governance and city management. The long term vision for Kigali balances upon these strengths. Several cities in the world have used good urban planning as a tool to position itself as a regional leader in city development. As such the proposed vision for City of Kigali is to become......

"The Centre of Urban Excellence"

While the central objective of the city vision is to obtain urban excellence, its 3 districts have been attributed with specific economic and social goals based on their innate strengths and potentials. As such the development focus for the three districts are:

NYARUGENGE :

"The Green Financial Hub and vibrant Growth Centre of Kigali"

GASABO :

"Diverse Employment Hub and Cultural Heartland of Kigali"

KICUKIRO :

"Knowledge Hub and Green Gateway of Kigali"

GOALS FOR KIGALI

To achieve the medium and long term visions for Kigali,a set of goals covering 5 critical sectors of development is proposed. These key goals will guide the physical planning for the City.

CITY OF CHARACTER, VIBRANT ECONOMY AND DIVERSITY

- Making Kigali a modern Regional Financial Hub in Africa
- Providing adequate working spaces for 1.1 mil in service sector jobs
- Providing adequate working spaces for 0.6 mil in industrial sector
- Promote high-value added agriculture and agro-based industries
- Minimum of 1 regional & recreational destination in each district
- Preservation of all historic and culturally important sites, and promotion of culture & heritage for locals and tourism.

CITY OF AFFORDABLE HOMES

- Slum Free City
- 90% home ownership
- 60% affordable housing
- 4 sqm Public Recreation open space / Capita
- 1 local open space within 400 m walking distance
- 99 sqm Total Open Space including nature areas

CITY OF ENCHANTING NATURE & BIODIVERSITY

- No development on steep slope
- Relocation of unplanned communities in steep slopes and full restoration of slopes above 40%
- Mandatory soil stabilization of all slopes above 20%
- A citywide Watershed Management Plan
- Flood free city for a 50 years of flood return period
- 100% conservation of all water bodies
- 20 m mandatory buffer for all water bodies (Organic Law)
- Zero net loss of existing forests
 Afforestation in slopes > 60%
- Reforestation to restore
- former forests
- Creation of innovative urban agriculture for slopes > 20%

CITY OF GREEN TRANSPORT

- Public : Private Transport ratio of 70:30 with excellent quality of public transportation
- 10% non-motorized Green Trips
- Length of expressway = 30 km / mil population
- 100% of National Roads and Class
 1 District roads to be paved and designed to international standards
- 1 hour connectivity to international transport terminal (e.g. airport, international rail station)
- 1 hour connectivity to major employment node
- 100% provision of pedestrian walkway along development side of the road
- 20 km / million Green Network

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CITY OF ENDEARING CHARACTER AND UNIQUE LOCAL IDENTITY

- Double tourist arrival in Kigali by 2025 (as per the Sustainable Tourism Development Masterplan for Rwanda)
- Develop at least 1 regional tourism destination in each district
- Double tourist arrival in Kigali by 2025 (as per the Sustainable Tourism Development Masterplan for Rwanda)
- Develop at least 1 regional tourism destination in each district

CITY OF SUSTAINABLE RESOURCE MANAGEMENT

- 20% lower water usage than world average
- Water Supply Network coverage: 75%
- Available supply: 80 lpcd(2025) & 120 lpcd (Yr X)
- Rainwater harvesting & Water saving devices: for all new urban developments above 0.4 ha
- Water leakage loss: 30% (2025) & 15% (Yr X)
- Temporary on-site STP for all new urban developments of 0.4 ha and above (2025); Centralised STP for each sector (Yr X)
- Sewerage Coverage: 20% (2025) & 75% (Yr X)
- Rural sanitation: Ecosan system or septic tanks developments of 0.4 ha and above
- Separate wastewater sewerage and storm water drainage: 20% (2025) & 75% (Yr X)
- Use of swales and constructed wetland to slow down storm water runoff in all new urban developments of 0.4 ha and above
- Proper slope protection for all new developments
- Recycling rate: 15% (2025) & 50% (Yr X)
- Illegal dumping & open burning: 25% (2025) & 0% (Yr X)
- 20% lower energy usage than world average
- 20% alternative energy source in the city

Strategies for Transformation....

TO ESTABLISH A RANGE OF EMPLOYMENT CENTERS IN KIGALI:

- To reintegrate and rejuvenate the city centre to become an attractive live work play destination
- Identify new nodes for regional & local level commercial uses to decentralization of development in the city
- Focus on creating of new industrial employment centres

TO CREATE AFFORDABLE AND QUALITY LIVING ENVIRONMENTS IN KIGALI:

- Revitalization and redevelopment of existing unplanned & low density built up areas
- Comprehensive townships
- Availability of variety of recreational and social amenities
- Establish new thematic features to enhance identity and add character to the city

TO IMPROVE CONNECTIVITY AND TRANSIT IN KIGALI:

- Development of an efficient highway and road network
- Development of a comprehensive public transit network
- Optimize regional connectivity and linkages

TO MANAGE AND IMPROVE THE ENVIRONMENT & INFRASTRUCTURE:

- Restrict urbanization and develop a compact walkable city
- Conservation and integration of all nature areas
- Develop an integrated waste and storm management framework

TO SECURE LAND RESERVES FOR FUTURE NEEDS:

- Identify strategic areas for successful development of Kigali in the future
- Secure and consolidate these strategic lands for future needs.



Development Strategy for Kigali

	TO RWAMAGAN / TANZANIA
	Regenerate the existing CBD and the civic and commercial nodes in Kimihurura and Kacyiru
•	Identify regional commercial nodes to distribute and decentralize development away from CBD and into suburban areas
	Redevelop unplanned areas as compact high density residential areas
	Rejuvinate the existing built up areas and city fringe
	Identify land for city expansion as compact integrated townships
0	Expand existing SEZ and develop industrial nodes along the major transit corridors to restrict the heavy traffic from entering the city centre
	Conserve and manage all nature areas
+-+	Develop adequate transport network between urban areas
	City Boundary

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

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CITY DEVELOPMENT CONCEPTS....

Guided by the direction set by the development strategies; two concept options are proposed which explore the alternative directions of future physical development of Kigali. The options explore various employment, housing, transit and transportation opportunities.

CONCEPT OPTION 1:

LINEAR CITY

The "Linear City" concept reinforces the existing east-west corridor in Kigali by concentrating transit oriented compact development in the central development spine and enabling integrated townships in newer areas.

Concept 1 recognizes the current development trend along the existing corridor and takes opportunity to capitalize on the existing growth pattern while organizing the new city around this central corridor. The key proposals of the concept are:

- Redevelopment of two development corridors: Eastern Corridor & Southern Corridor
- Development of new gateway nodes at Kabuga and Gahanga
- Townships with Trunk and Feeder Transit System with mix of BRT & MRT
- Prefer Redevelopment of Airport land in the medium term to support cities affordable housing needs by allowing high density growth along the corridor.





BRT + Metro





CONCEPT OPTION 2:

RADIAL CITY

The "Radial City" concept proposes the creation of new transit oriented development corridors and promotes development of new townships along it.

Concept 2 focuses on developing new integrated transit-oriented township in the less developed areas of Kigali and promotes strategic land banking to develop future planned urban areas. The key proposals of the concept are:

- New Development Corridors in the newer areas of Kicukiro and Gasabo.
- Strengthening CBD & development of new regional nodes
- Township integrated with BRT corridors
- Possibility to retain Airport with focus of growth away from the E-W corridor.
- Radial Road Network with public transit (BRT mid term, MRT long term)





BRT + Metro

Road Betwork

Concept 2 : Radial City

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

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	ONS	
EVALUATION CRITERIA	LINEAR CITY	RADIAL CITY
Growth Focus	 Focuses on existing east- west corridor in the city Follows existing growth pattern and development demand High density development along the two corridor and medium density in the NS corridor 	 Focuses on newer less developed areas Growth nodes in greenfield areas High density development around the CBD and 3 Major L
City structure & Commercial Distribution	 Development of two high capacity corridors: eastern & southern corridors. Distinct gateway node at Kabuga and Gahanga. 	 Radial extensionn of the city creating new growth corrido Multiple regional commercial nodes creating distinct new
Transport System	• A fish bone pattern transit structure which combines high capacity Mass Rapid Transit and feeder BRT lines.	Multiple radial transit lines links to the centre with feede
Government involvement and implications	 Government as a Facilitator and Regulator –Lesser government intervention as the large part of implementation by rezoning. Lesser control on density optimization due to current trend of low density development along the EW corridor Need additional funding resources for MRT development. Relocation of existing Kigali International Airport to optimize on the potential for high density development in and around the airport. 	 Need additional funding for strategic land bank. Not impacted by the height constraints imposed by the e Government can play a larger role in providing of affordate intervention in terms of land acquisition to implement the Current airport remains operational till 2025.











Various Stakeholder Meeting



To enable the selection of the most suitable development concept for Kigali, the concept options are compared and evaluated.

Option 1 (Linear City): requires less government intervention as it follows the growth pattern centred along the main development corridor. This option will be more difficult to implement as you will have to rely heavily on the market forces to achieve to the planning objectives. This option also requires the airport to be redeveloped.

Option 2 (Radial City): requires more proactive role by the government to secure adequate land banking for the township. The urban development in this option is more evenly distributed and features multiple growth nodes. This option also allows for the airport to be retained.

RECOMMENDED CONCEPT OPTION:

In March & April 2012, the two concept options were presented to various stakeholders at city as well as district levels. Based on the deliberations of the pros and cons of the options, Option 2 (Radial City) was recommended as the preferred long-term concept option for the future development of Kigali, as it offers:

- Emphasizes on development in the newer developable areas.
- Promotes land banking along the transit corridors for future development opportunities.
- Promotes developing compact new townships with affordable housing which are well integrated with the proposed transit network.
- Focuses on distribution of commercial by creating multiple commercial nodes in the city.
- A new radial road network that distributes the traffic in a clearer manner.
- Facilitates even distribution of future employment and industrial areas in the city.
- Retains of the airport for strategic reasons upto the medium term.

The Way Forward:

The selected planning concept option sets the broad planning directions and the regional structure of Kigali. This concept, however, is not cast in stone; a deeper planning analysis will be undertaken in the subsequent stage to refine the concept further before the structure plan is finalized. Task Order 3 (Conceptual Planning) involves transportation concept planning, preliminary traffic modelling, preliminary infrastructure proposal as well as the concept plan for the two districts. As per the stakeholder's request, a draft zoning plan will also prepared and presented for discussion.

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INTRODUCTION

REPORT BACKGROUND AND PURPOSE

Having completed the data collection, reconnaissance and base mapping process in Task Order 1, the 2nd Task Order of the Design of Detailed District Physical Plans for Kicukiro & Gasabo Project involves the context analysis, vision and development of concept options for the City of Kigali. The Analysis, Benchmarking and Visioning Report is a part of this 2nd task order of the project. Presented below is a list of all reports due for this project:

Task Order 1:

Inception Report

Task Order 2:

 Analysis, benchmarking and Visioning Report

Task Order 3:

- Conceptual Kigali Transportation & Infrastructure report
- Gasabo Conceptual Plan report
- Kicukiro Conceptual Plan report

Task Order 4:

- Final Transportation & Infrastructure Master Plan report
- Final Gasabo Master Plan report
- Final Kicukiro Master Plan report
- Gasabo Zoning booklet
- Kicukiro Zoning booklet

Task Order 5:

- Gasabo Town Centre Urban Design report
- Kicukiro Town Centre Urban Design report
- Gasabo Town Centre Zoning booklet
- Kicukiro Town Centre Zoning booklet

Task Order 6:

• Implementation report

The purpose of this report is to elaborate the existing analysis, the international benchmarking and the development vision suggested for the City of Kigali. It also presents the key development strategies based on this vision and two concept options for future city development.

METHODOLOGY

In order to develop the physical city development concepts, in-depth analysis of various planning issues affecting the City have been undertaken.

The process adopted during this task order of the project can be elaborated as below:

- Detailed analysis of existing context and future growth scenario of the City
- Establishing the Urban Sustainability Framework for Kigali to address the key economic, social and environmental issues
- Benchmarking of city planning and management indicators with relevant and comparable cities
- Determining the broad land requirements for accommodating various future land uses
- Setting the development vision for Kigali City
- Establishment of the physical city development strategies
- Preparation of various concept options for city development & identification of the preferred physical development direction of the city

ORGANIZATION OF THE REPORT

In addition to this chapter, the report consists of other following chapters:

Chapter 2: Kigali Existing Context and Conditions

The key objective of this section is to present an in-depth analysis of the onground conditions of City at present, as well as to take stock & review all the past & current planning initiatives that have been undertaken in the City. Several key sectors have been focused upon for this analysis phase, which includes economic, social & demographic growth, employment, nature & environment, housing, transportations, utilities & infrastructure, land use and related laws and systems, etc.

A series of intensive interviews, meetings with more than 50 agencies and individuals was undertaken for about 2-3 months. This section presents the record and analysis of all such collected data and the issues and key implications which will impact and feed into the master plan preparation.

The key outcomes & insight received from this stage are summarized and presented as opportunities and constraints map for Kigali which form the basis for undertaking detailed physical planning for the City.

CHAPTER 3: DIMENSIONS OF GROWTH

To understand the future growth potentials of the City a separate socio-economic study was undertaken. The socio-economic study profiles the short, mid and long term indicators for Kigali's economic, employment & demographic growth. This data is the key input to estimate the quantum of land & resources that need to be prepared for and reserved to secure a planned future for the City. This section presents the key highlights of the socioeconomic study.

CHAPTER 4: URBAN SUSTAINABILITY FRAMEWORK & DEVELOPMENT VISION

The Urban Sustainability Framework (USF) for Kigali targets on the key triple-bottom line - economic, social & environmental - issues for Kigali and sets the broad direction & recommendations targeted at resolving these key issues. The USF forms the first broad matrix which would set the overall planning direction. Subsequent to the USF the long-term development vision for the City has been set to position Kigali in the Regional settings. Vision Kigali not only addresses the existing context, but also optimizes on its strengths and potentials. It forms the central aspiration which would encourage the City's development and progress. To help achieve this central vision, a series of sector specific goals & strategies, which have been benchmarked against successful cities of comparable contexts, have also been proposed which form the general development programme for the City.

Chapter 5: Broad Land Requirements

In order to guide the physical planning works, the strategies and recommendations for the USF & Vision are translated into quantifiable land requirements for the different future land uses in the City. This section elaborates the total land needed and the land development programme for Kigali. CHAPTER 6: DEVELOPMENT STRATEGIES & CONCEPTS FOR KIGAli

In order to guide physical development of the City, various land use strategies are suggested in this section followed by 2 possible concept options which show the different ways in which the City can grow in the future. These development strategies and concept options were presented to various stakeholders for review and selection.

The selected concept option would be further detailed out and elaborated in the coming stages of the project.

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KIGALI: EXISTING CONTEXT & CONDITIONS





Fig.2.1 Kigali City Location (Top Left) , Linkages (Top Right) and Regional Context (Bottom)

2.1 Location & Connectivity

2.1.1 LOCATION

Located amidst Central and East Africa, Rwanda is bordered by Uganda, Tanzania, Burundi and the Democratic Republic of the Congo. Kigali, located in the geographical centre of Rwanda is the administrative and commercial Capital and the largest City of the country. The city is bounded by the Nyabarongo River along the western and southern edge, and partly by Lake Muhazi in the north eastern edge.

2.1.2 CONNECTIVITY

The regional Northern Corridor comprises of the inter-country highway which connects Kigali City to Kampala, Nairobi and Mombasa. The Central Highway corridor connects Kigali to Dar-es-Salaam and Bujumbura. Kigali is globally connected by the existing Kigali International Airport which is situated in the heart of the City along the east-west national highway. This highway connects the City to the neighboring towns of Rwamagana in east, and Gitarama in west, and to the other larger towns of Kibuye, Nyanza and Butare in Rwanda. The northern highways connect the City to Byumba in the north and the tourist destination -Ruhengiri in the northeast and Gisenvi in the far-east.

In order to support the increasing air traffic, the new International Airport is proposed to be developed in Bugesera which lies about 26 km south-east of the City. The road connecting the City to Bugesera holds special significance as a potential growth corridor that has been identified as the suitable location for future City Centre by the Kigali Concept Master Plan (KCMP)¹. Major paved roads only occur in the urbanized areas of the City and most of the roads in the rural areas are in the form of mud tracks.

2.2 Role in the Regional & National Context

Some of the prominent neighboring cities in the region include Nairobi, Kampala Addis Ababa, Kinshasa and Lagos with major Ports in Dar-es-Salaam (Tanzania) and Mombasa (Uganda).

In the national and regional context, Kigali is envisioned to be the Regional Hub for Rwanda and a Continental Hub for Africa. Further to this, the National Land Use Master Plan (NLMP)² proposes a decentralized growth strategy for Rwanda which recommends growth to be focused in multiple district centres apart from the Kigali Urban Hub.

The KCMP and the Detailed Master Plan for Nyarugenge³ supports the vision for Kigali to become the regional economic hub.

 KCMP (2007), is the first broad Conceptual Master Plan prepared by OZ Architects to guide long term urban growth in the City of Kigali.
 NLMP (2010), is the national level Land Use and Development Master Plan prepared to guide use and management of land in Rwanda for efficient, effective and equitable use of country's natural resources.

3 Detailed MP for Nyarugenge (2010), is the first Detailed Master Plan with zoning guidelines prepared for Nyarugenge District. The study also includes a separate Master Plan with Urban Design Guidelines for the Central Business District (CBD)of Kigali. The KCMP further proposes connections between the major regional and economic centers in Rwanda such as the new Bugesera International Airport and the new City Center at Gahanga with existing centers of economic activity such as Nyarugenge City Center, which is proposed to be revitalized as a vibrant CBD in the Nyarugenge Master Plan. Further to this, the National Tourism Master Plan (NTMP)⁴ positions Kigali as a hub for MICE Tourism, conferences and businesses in the region.

While it is highly probable that there will be sprawling developments along the regional connections to Kigali in addition to the designated urban growth around designated District Centres, the growth shall be contained within the urban centres of Rwanda. It is recommended to have a national regional growth and development strategies for these different key urban centres at Rwamagana, Kibuye, Nyanza and Byumba and other sub regional urban centres around the smaller towns of Ruhengiri, Gitarama, Gikonjoro, Butare, Kibungo and Nyagatara within Rwanda.

⁴ NTMP (2009), is the sustainable Tourism Master Plan prepared to guide the world-class tourism development in the Country.

2.3 Planning Area & Administrative Divisions

The City spreads over 731.24 sq km of land and comprises of 3 districts namely Gasabo, Kicukiro and Nyarugenge. The Gasabo District located in the north is the largest amongst three, followed by Kicukiro and Nyarugenge. The detailed planning of Nyarugenge District was completed in 2010. Detailed plans for gasabo and Kicukiro are to be developed to create an integrated detailed plan for the entire city of Kigali. The planning direction and strategies for the whole of the Kigali City are under review to create an updated city wide master plan.

Altogether, the 3 districts comprises of 35 administrative sectors which are further divided into 160 cells as illustrated in Table 2.1.

Table 2.1	City of	of Kigali	Planning	Areas
		o		,

PLANNING AREA	SIZE (HA)
NYARUGENGE	13423
GITEGA	117
Kanyinya	2465
Kigali	3031
Kimisagara	320
MAGERAGERE	5502
Миніма	292
Nyakabanda	240
Nyamirambo	895
Nyarugenge	456
Rwezamenyo	103

PLANNING AREA	SIZE (HA)	
GASABO	43002	
Bumbogo	6019	
GATSATA	603	
GIKOMERO	3487	
GISOZI	850	
JABANA	3651	
JALI	3758	
Kacyiru	582	
Kimihurura	489	
Kimironko	1146	
Kinyinya	2464	
Ndera	5026	
NDUBA	4681	
Remera	704	
RUSORORO	5256	
Rutunga	4286	
KICUKIRO	16702	
Gahanga	3669	
GATENGA	1133	
Gikondo	352	
Kagarama	968	
Каномве	2460	
KICUKIRO	213	
Kigarama	778	
Мазака	5240	
NIBOYE	504	
Nyarugunga	1384	
TOTAL	73128	

Source : KCMP 2007



Fig.2.2 Kigali City Planning Area

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Fig.2.4 Directives for Sustainable Land Use Planning 2020 Source : National Land Use Master Plan



SCENARIOS	GDP GROWTH RATE	NATIONAL POPULATION IN 2020	Share of Urban Population	KIGALI'S SHARE OF URBAN POPULATION	Kigali's Population in 2020
Red	9.6%	14.1 MIL	50%	40%	5.18 MIL
Yellow	8.5%	13.8 MIL	40%	20%	2.59 MIL
GREEN	7.6%	13 MIL	30%	10%	1.29 MIL

Source : National Land Use Master Plan

2.4 Land Utilization Pattern & Trends

Today, a large part of the urban areas in Kigali are unplanned, under serviced and growing haphazardly. The recent planning initiatives at national as well as City level have helped Kigali guide its urban development. At the national level, a Land Use and Development Master Plan was put in place in 2010 to guide management of land in Rwanda towards efficient, effective and equitable use of the country's natural resources. The City is also undergoing a national level land registration programme for efficient land administration and management. In 2007, the first long term conceptual Master Plan was prepared for Kigali to guide long term planning in the City.

2.4.1 RWANDA LAND USE AND DEVELOPMENT MASTER PLAN

The national master plan accounts for the current situation of land management in Rwanda, land administration and



Fig.2.3 Land Administration Organization Source : National Land Use Master Plan

institutional framework, laws and regulations that govern the use of land. It also addresses the current housing situation.

Currently land administration is done at two levels. At the national Level, Ministry of Natural Resources (MINIRENA) is responsible for macro land administration matters. The delivery of land-related services have been decentralized to district level administration.

While the Master Plan provides multiple national growth scenarios and broad guidelines for different sectors such as environment, land use management, urbanization, housing, transport and infrastructure; it does not focus on conditions for land management aspects lower than at District level.

NATIONAL URBAN GROWTH SCENARIOS

The National Land Use Master Plan highlights the need for revitalization of secondary urban growth centres. Three

urbanization scenarios namely Red, Yellow and Green Scenarios for the year 2020 are explored based on different population and GDP growth scenarios; and the share of urban and rural populations. The key objective is in line with the national vision to achieve middle income status and to halve poverty by 2020. The national plan presents the 'Green Scenario Plan' as a preferred path of urban development for Rwanda. The Green Scenario proposes decentralized development of attractive District Centres to meet the expectations of citizens from rural areas and to control the rural-urban migration.

KEY RECOMMENDATIONS

Some of the key recommendations made in the National Land Use Master Plan that are relevant to Kigali are:

- Kigali is positioned as a regional hub with integrated transport and infrastructure that will attract international investments to Kigali.
- The informal settlements in Kigali are proposed to be rehabilitated to medium density developments.
- The specific development potentials are identified for the 3 Districts: 1)Potential for Arts, Craft and Tourism in Nyarugenge District; 2) Potential for Tourism and Agriculture in Gasabo District; and 3) Potential for Arts, Craft and Agriculture for Kicukiro District.
- Urban area in Kigali has tripled in 25 years and hence the densification measures are recommended for Kigali City.
- Recommended densities include 5000 persons/ sq km for Low Residential, 10000 persons/ sq km for Medium Residential and 30000 - 50000 persons / sq km for High Residential.

• Recommended dwelling unit sizes include 30 sqm for the smallest unit, 60 sqm for medium size unit and 120 sqm for the larger units.

PLANNING IMPLICATIONS

- Apart from being positioned as the National Regional Hub, Kigali City's Vision needs to be further elaborated to capture the long term potential and aspirations of the City.
- The Concept Plan for Kigali looks at the long term planning horizon beyond 2020.
 Hence, detailed city specific long term economic and demographic studies need to be conducted to assess the growth possibilities for Kigali for detailed master planning and city programming.
- Some of the national level recommendations such as densities and dwelling unit sizes will vary for the Capital City and may need to be intensified. Based on the estimated population growth, the City will require to be organized into structured urban areas with appropriate urban density management.
- Social and economic roles for the 3 districts need to be further elevated so as to help Kigali to position itself as the premier urban node of Central Africa.

2.4.2 NATIONAL LAND REGISTRATION PROJECT

The National Land Registration Project is the National Land Tenure Regularization initiative under National Land Center (NLC) to manage and administer the land through a systematic process that brings together all the land holders including the State for registration and titling of their land.

The programme allows the land holders to make a claim to the land by identifying their land parcel to the Adjudication Committee, which is made up of Cell Land Committee, Umudugudu Leaders and a team of Para-Surveyors.

The primary objective of this programme is to promote a fair and speedy adjudication of claims of rights to individual, State, District and Kigali City's lands. Further to the adjudication, the programme facilitates the classification, and registration of the occupation and use of land.

LAND TENURE REGULARIZATION PROCESS

The prioritized Sectors and Cells are identified by the District Land Bureau and the District Land Commission; and notified for land regularization. Upon notification, the Adjudication Committee is appointed and subsequently the information is disseminated explaining purpose and benefits of land regularization. The agreed land boundaries are then assigned with a unique number and the claim receipt is issued to the land holder. In the process, the objections and disputes are addressed by the Adjudication Committee and eventually registered in the National Land Centre database showing the cadastral delineation and the size of parcel. The maps are further posted in the Sector or Cell Office for verifications upon which final registrations are conducted and lease titles are issued.

PLANNING IMPLICATIONS

• The delineation part of the Land Registration Project has been completed for the City of Kigali. However, the parcels have not yet been assigned with the details such as individual / public ownership, unique identification numbers and the use of land. Hence, the existing land use map requires preperation based on the satellite imagery and the site inspection.

 While land is liberally registered based on personal claims in Rwanda today, are potential difficulties in pooling the



Fig.2.5 Procedure for Land Tenure Regularization Source : Land Tenure Regularization, NLC

land together for public uses. This is especially so in the City of Kigali which is currently at embryonic stages of urban development and will require huge public infrastructure in the long run.

to Undergo LTR
tion, Appointment and es and Para-surveyors
g Aerial Photographs
rsonal Details Issuing cording Objections
e Field and Data Entry
Records, Objections and lizing the Recordings of the Disputes
Claims With Objections or Corrections
Abunzi/Dispute Resolution or Other Mediation
nd Preparation of Leases



2.5 Kigali Conceptual Master Plan

The key objective of the Kigali Conceptual Master Plan was to move forward from the National Strategic Plan proposed in Vision 2020, and to develop a long range plan for the Capital City that would guide the key infrastructure and systems required for the future growth of Kigali.

The Kigali Conceptual Master Plan was prepared for a long term horizon of 30 - 40 years to accommodate 2 - 3 Million people. Three different growth Scenarios have been explored assuming different possibilities of socio - economic growth in Kigali City.

The Master Plan provides an in-depth analysis of the current situation and proposes the broad land uses addressing the need for different housing densities, infrastructure needs, the conceptual transportation network, management of natural features and the implementation strategies.

Table 2.3 Kigali Conceptual Master Plan Growth Scenarios

SCENARIOS	GDP ANNUAL GROWTH RATE	GDP Per Capita *	P O P U L A T I O N ANNUAL GROWTH RATE	POPULATION 2025
LOW PROJECTION	9.6%	\$243	2.31%	1,390,070
BASE PROJECTION	8.5%	\$408	5.45%	2,568,960
HIGH PROJECTION	7.6%	\$716	8.50%	4,500,594

Source : Kigali Conceptual Master Plan 2007

* Low Projection of GDP based on population growth Base Projection of GDP based on Comparison data and Consensus Estimates High Projection of GDP based on Case Studies and Vision 2020

Fig.2.6 Kigali City Conceptual Masterplan Land Use Plan Source : Kigali Conceptual Masterplan Report

2.5.1 Key Planning Strategies

- The Master Plan acknowledges the broad national vision for City of Kigali as a hub in new Africa. It further envisions the city as a leading model of a new, economically thriving, democratic, and progressive African city, redeveloped with integrated infrastructure and services; is economically sound; ensures personal safety and security; celebrates the country's rural/agricultural heritage; and becomes a regionally and internationally integrated commercial and administrative hub.
- The proposed urban growth is defined by natural features and environment based infrastructure.
- The urban structure is organized in the environment friendly "Transect Concept" proposing different land uses and densities in response to the topography and to each other. Hence, the high density, medium density and key commercial urban areas are proposed along the ridges; followed by the low intensity uses such as rural residential, agriculture and

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reforestation, which are proposed along the wetlands and valleys.

• The Master Plan hinges on a decentralized urban growth strategy and proposes several regional urban nodes with clusters of residential, commercial, government, office and other institutional uses together. In addition to the Nyarugenge City Centre, a new city centre in Gahanga is identified along the highway connecting the existing city centre and the proposed Bugesera International Airport in the south.

2.5.2 PLANNING IMPLICATIONS

• The Master Plan assumes the proposed population of 3 Million by 2030. The socio- economic conditions of Rwanda has changed over the last five years. The economy has grown faster than anticipated and hence, the socio-

economic conditions need to be reviewed with an optimistic and longer term approachtowards 2040 and beyond.

- The general Transect Concept needs to be contextualized based on some of the key planning principles such as available habitable zones; efficient distribution of urban nodes and transportation network; as well as the optimal overall city structure.
- The Conceptual Master Plan is limited to new growth areas and the existing urban area needs to be integrated into the new Kigali Concept Plan.
- The Real Estate Demand needs to be analyzed and estimated to plan for the additional commercial nodes. Hence, the regional role of Gahanga needs to be reexamined.
- There is a need of detailed land use classifications and specific zoning guidelines in order to realize the Conceptual Master Plan.







LEGEND

--- District Boundaries Wetlands Lakes 15m Contour Major Highways Other Roads National Park Rwamagana District Rwanda Towns Urban Area River Major Paved Highway

Fig.2.7 Kigali Conceptual Master Plan - Distribution of Regional Urban Nodes Source : Kigali Conceptual Masterplan Report

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Rwamagana Towns

Proposed Outer Bypass

New Airport

Proposed Major Paved

🚥 🎟 Proposed Railroad Alignment Existing Major Urban Node 👛 Proposed Major Urban Node Minor Urban Node



2.5.3 EXISTING LAND USE DISTRIBUTION

Due to the topographical constraints, almost 83% of the City is natural unplanned areas and rural agrarian land. Urban land uses such as residential, commercial, industries, and social and infrastructure facilities occupy around 17% of the City's land.

The urban area in Kigali City today is largely centered around the existing City Centre at Nyarugenge and spreads along the east west highway towards the Kigali International Airport in the east. Although the historic agglomeration of the City is to be clustered around the City Centre, the new growth areas are developing along this major transport corridor. This is found to be quite similar in most of the developing cities.

Most of the commercial activities are clustered around the Centre Ville

Table 2.4 Existing Land Use Distribution

LANDUSE TYPES	AREA IN SQKM	Percent
RESIDENTIAL	67.58	9.2 %
COMMERCIAL	2.85	0.4 %
Mixed Use	0.22	0.0 %
PUBLIC FACILITIES	13.74	1.9 %
INDUSTRIES	4.41	0.6 %
NATURE AREA	141.98	19.4 %
AGRICULTURE	461.37	63.1 %
OPEN SPACE	2.171	0.3 %
WATER BODIES	2.905	0.4 %
Infrastructure/Roads	20.84	2.8 %
SPECIAL USE	13.46	1.8 %
TOTAL AREA	731.53	100%

Roundabout and along the ridge in Nyarugenge Sector. The launch of CBD Phase 1 in Muhima has strengthened the existing City Core with new offices and commercial spaces and allowed Nyraugenge CBD to grow northwards. Furthermore, there are many local market places spread around the urban areas of Kigali and smaller rural market centres in the peripheral sectors of Kigali.

There are significant civic uses in Kacyiru, Kimihurura and Nyarugenge with clusters of government institutes, embassies and other non governmental organizations.

Additional employment areas comprise of industrial uses around Gikondo close to the CBD, in Gatsata along the northern highway and recently developed Kigali Special Economic Zone Phase -1, which is located in close proximity to the existing international airport.

2.6 Environment, Topography and Developable Land

2.6.1 TOPOGRAPHY, GEOLOGY & SOIL TOPOGRAPHY

Kigali City is built on hilly landscape sprawling across ridges and wetlands with an altitude varying between 1300-2100m. The Nyarugenge District is dominated by strong linear ridge running north-south with a maximum altitude of 1900m and softens towards the flat alluvial planes of the Nyabarongo River on the west. The Gasabo District constitutes of more aggressive relief due to the tight rectilinear ridges oriented northwest with a maximum altitude of 2100m to 1900m and gentle relief along the Nyabugogo River and southern part of the district. The Kicukiro District is composed of gentle slope plateaus, avereging less than 1700m of altitude and the slopes gently settle into the alluvial plains of the Nyabarongo River.

As per Organic Law the slopes more than 20% are not suitable for urbanization. This is demonstrated in the slope analysis map (refer Fig.2.10). (In Nyarugenge District 37%, Gasabo District 37.5%, Kicukiro District 6.8% area is occupied by steep slopes.) The slopes of Kicukiro District are relatively gentle compared to other two districts with 15562 ha land below 20% slope available for development compared to Gasabo District (26891 ha) and Nyarugenge District (8401.4 ha).

GEOLOGY & SOIL

The City of Kigali is underlain by granitic and meta-sedimentary rocks. The degree of metamorphism undergone by the sediments is generally low. Primary rocks observed in the city are schists, sandstones and siltstones.

The surface of the city is dominated by lateritic soil along the hillsides and alluvial soil along the marshlands. There are four general types of soil found in Kigali; lateritic soils, arkosic sands, colluvium(slope wash) and alluvium (river deposits). The valley of Nybogogo and Nyaborongo River provide a fertile belt of alluvial soil suitable for agriculture where as the hilly slopes have undergone soil erosion for a long time, leaving them bare and less productive. ¹

2.6.2 ISSUES & CHALLENGES

- 35% of the entire city land area is occupied by steep slopes of more than 20%, 21% of which are not yet build upon and 14% located within urban areas, mostly encroached by unplanned settlements. As per the Rwanda National Land use Development Master Plan (RNLUMP) Kigali City land area falls under medium to high risk soil erosion zone and soil present on more than 5% slope is susceptible to heavy erosion.
- Land degradation is linked to widespread land clearance and over cultivation. Heavy soil erosion reduces soil fertility and heavy silt load depletes river and wetland habitats.
- In many parts of the city the developments are happening along the steep slopes of Gatsata, Gisozi, Ramera, Kicukiro etc.
- The city lacks sustainable slope management and erosion control policies.

1 KCMP report, COK economic development strategy report

TO RUHENGER KICUKIRO DISTRICT d refinement by the GIS, City of Kigali,

Fig.2.10 Slope Analysis Map

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GOVERNMENT STRATEGIES, CONSERVATION AND MANAGEMENT EFFORTS

The RNLUMP restricts urban development on more than 20% slope. The water bodies and wetlands are protected by Environmental Law with a suggested buffer of 10m for rivers, 50m for lakes and 20m for wetlands . In hilly areas of Bumbogo, Kinyinya, Jabana, Gihogwe etc agricultural land is managed by terrace cropping and agro forestry techniques initiated by Ministry of Agriculture and Animal Resources (MANAGRI). Landscape beautification works are carried out to stabilize the steeps slopes. Still the efforts observed in each environmental sector are piecemeal and there is a lack of a coordinated land management plan which identifies the priority areas for urban growth, agriculture and environmental conservation.

2.6.3 WATER BODIES, WATERSHED & DRAINAGE RIVER AND LAKE SYSTEMS:

Major lakes and rivers surrounding Kigali City are, lake Muhazi which borders the city along northeast of Gasabo District and Nyabarongo River bordering Nyarugenge and Kicukiro Districts along the south west. There are also other rivers and streams, such as Yanze, Kibumba, Rwazangoro and Ruganwa which flow into the Nyabugogo stream, which in turn flows into the Nyabarongo River to the west. Many other streams from the southern hills of the city, flow directly down in the Nyabarongo River which finally drains into Lake Rweru, one of the sources for the Akagera River that feeds Lake Victoria.

WATERSHED & DRAINAGE

The undulating topography divides the city into 25 watershed areas defined by hilltops, ridges, valleys and wetlands as shown in the Fig.2.11. The City of Kigali consists of terrain varying from very steep hillside slopes up to 45% to 50% and valley wetland areas with slope less than 2%. The watersheds from central and northern Kigali are relatively steep and drain north into Nyabogogo River, then to the Nyabarongo River in the west of Kigali City. The southern and eastern portion of Kigali is relatively less steep and directly drains into the Nyabarongo River.

ISSUES & CHALLENGES

- The turbidity of Nyabarongo River is very high due to significant sediment load, organic debris and other runoff contaminants. The quality of water in the Nyabugogo River is generally poor because it drains much of the Kigali City and receives pollutants from uncontrolled residential and industrial sources.
- River flood plains and wetlands are extensively used for cultivation within the city, which damages the existing wetland vegetation. The use of pesticides and chemical fertilizers are further degrading its water quality.
- Urban encroachment, heavy soil erosion and improper management of watershed areas lead to the increasing localized flooding in the areas of Nyabogogo taxi stand, Gikondo Industrial Zone etc.

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Fig.2.11 Water bodies, Watershed and Drainage Map

GOVERNMENT STRATEGIES, CONSERVATION AND MANAGEMENT EFFORTS

As per the law it is mandatory to provide a 10 m buffer for the water bodies and a 50m buffer for the lakes. However there are no policies and guidelines for the management of watershed areas. Currently MINIRENA is formulating a separate authority for integrated water management which will provide detail planning and management framework for water bodies and watersheds. To address urban encroachment and soil erosion problems REMA is currently developing programs for river and lake shore rehabilitation.

2.6.4 Wetlands The Wetland System in Rwanda:

Marshlands are the most physically and chemically heterogeneous of all aquatic ecosystems in Rwanda. They are in effect seasonal wetlands. The water table is near or above the lowest ground surface during the wet seasons and they do not have large flood plains or great length.

The most recent inventory of wetlands was conducted in 2008 by Rwanda Environmental Management Authority (REMA) through the Integrated Management of Critical Ecosystems (IMCE) project funded by GEF and World Bank. According to this report there are seven types of wetlands found in Rwanda namely; 1. High Altitude Swamps

- 2. Volcanic Highland Swamps
- 3. Central Plateau Swamps
- 4. Swamps of Kanyaru- Nyabarongo and Akagera Basins
- 5. Swamps in the East
- 6. Swamps of Bugarama Depression.
- 7. Swamps on the Edge of Lake Kivu

These wetlands are classified on the basis of; relief, altitude, soil type, vegetation, hydrology and size of the swamp, slope of the watershed and population density.

WETLANDS IN KIGALI

The Kigali City contains a complex system of wetlands, present along the low-lying valleys adjacent to the rivers. These wetlands cover 14% of the total land area of the city, approximately 10,000 hectares.

According to the IMCE classification explained above, wetlands of Kigali are the Central Plateau Swamps mostly present on the altitude of 1400m to 1800m. These wetlands possess mineralized soil type (clay sandy, limono sandy) and the dominant vegetation is Polygonum pulchrum, Cyperus papyrus, Commelina diffusa, Cynodon dactylon, Eicchornia crassipes, Pennisetum purpureum etc. The main function of wetlands within the city is to act as a water reserve and agricultural production.

ISSUES AND CHALLENGES:

- Most of these wetlands are surrounded by densely populated steep slopes, intensively used for settlement structures, cultivation and grazing. These developments alter the watershed, increase soil erosion and siltation in the wetlands.
- The principal threats to wetlands of Kigali are linked to agricultural (mainly rice and sugarcane), livestock activities, human settlements, industries and sand quarries.
- There is pollution from sources such as domestic effluents, waste leachates, industries, agro-chemicals and storm water.
- There are negative impacts on the



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DISTRICT PHYSICAL PLANS FOR KICUKIRO AND GASABO, KIGALI, RWANDA






Fig.2.13 Diverse Fauna in Kigali



Fig.2.14 Environmentally Sensitive areas in Kigali







Fig.2.15 Industries in environmentally sensitive areas in Kigali



wetlands ecosystem observed as biodiversity loss and disturbance of the ecological functions of wetlands. Alteration of these wetlands significantly reduces the range of their ecosystem services, including flood control. A study conducted by REMA (2006) concluded that only below 24% of Kigali's original wetlands are remaining.

GOVERNMENT STRATEGIES, CONSERVATION AND MANAGEMENT EFFORTS

In Rwanda wetlands are protected and utilization is regulated by Organic Law. Currently Rwanda Environmental Management Authority (REMA) is working with the National Land Center (NLC) to finalize the wetland boundaries. For better management and implementation of policy works, the wetlands will be categorized into three zones based on their environmental value and use. These include:

TOTAL PROTECTION WETLANDS: protection at its natural state no agriculture and other activities will be allowed. There are no natural wetlands left within the Kigali City limits except for a few patches of Nyabarongo wetland.

CONDITIONAL USE WETLANDS: allows

continuation of existing agricultural activities and conditional use for infrastructural projects with proper EIA assessment (wetlands mainly along the rural areas).

UNCONDITIONAL USE WETLANDS: will not require environmental impact assessment but no development activities will be allowed. These wetlands could be used for recreation, parks, fishing ponds, horticulture etc. (wetlands mainly along the urban areas of Muhima, Kimihurura, Kicukiro etc.)

BIODIVERSITY AND GREEN COVER

VEGETATION

Kigali City was once heavily forested, but now native forests have been largely removed as a result of population growth and extensive subsistence farming. Today the natural forests are available in small scattered patches and the man-made forests are dominated by Eucalyptus plantations which are used for agroforestry.

Natural vegetation is almost nonexistent in the city and subjected to burning under traditional agro-pastoral and subsistence farming system. However, some natural vegetation is present in small scattered patches and the wild plants exist in the marshes and small uncultivated corners. Low lying areas of river floodplains and wetlands are dominated by Rice and Sugarcane plantations with very little natural vegetation exists along the source of the Nyabugogo River and a few patches exist along the Nyabarongo River.

WILDLIFE

Rapid deforestation due to cultivation and urbanization has led to the serious destruction of biodiversity in Rwanda. Currently significant species of mammals, amphibians and reptiles are found only in the National Parks of Volcanoes, Akagera and Nyungwe. The Nyabarongo Wetland receivesan exceptionally large number of migratory and congregatory birds every year.

Hence, the biodiversity of fauna in Kigali is relatively low and it is composed of species of birds and reptiles hares, jackals, few species of snakes and fishes. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

BIODIVERSITY CONSERVATION AREAS

Nyabarongo River Wetlands which borders the Kigali City on Western and Southern sides are identified as an Important Bird Area (IBA) biodiversity conservation hotspot in the RNLMP, as it receives an exceptionally large number of migratory and congregatory birds every year.

ISSUES & CHALLENGES

- Burning of forests under traditional agropastoral system.
- Existing small patches of the natural forests in the city are highly fragmented and there are no stringent guidelines for the protection and management of these areas.
- Attempts to address erosion and reduce illegal use of protected areas have seen the plantation of unstable slopes and forestry buffers with Pines and Eucalypts. Eucalypts and Pines are highly flammable and their proximity to native forests increases the risk of habitat destruction from wildfires.

GOVERNMENT STRATEGIES, CONSERVATION AND MANAGEMENT EFFORTS

Vision2020 identifies Environment protection as an important crosscutting area and the suggested strategies recommend a 3 km development buffer for biodiversity protection areas and habitat corridors. There is a lack of effective national level legal framework and management policy for integrated wildlife and biodiversity management. Similarly in the Kigali City there are few efforts for conservation and management of wildlife and biodiversity areas.

2.6.5 Agriculture Agriculture in Kigali City

As per the Kigali Economic Development Strategy report 2002, the agricultural sector contributes to household's income, food and employment. Agriculture activities are mostly visible in the peri-urban areas of all communities. It is estimated that the sector provides employment to about 5% of the working population in the city, of which 73% are women.

The arable land available for agriculture could not be determined from the available data on agriculture but it is mostly located along the swamps and lowlands. The average land acreage per farmer-households is 0.7 hectares of which an average of 0.68 hectares is cultivated.

The total agricultural land area in the City of Kigali is approximately 63%. The distributions of crops grown is mainly traditional food crops with sweet potatoes, bananas and beans being most dominant. Other crop grown include Irish potatoes, Soya beans, maize, cassava, vegetables and coffee in small amounts. Average 65% of crops produced are consumed by the farmer's families and remaining 35% is sold in the local produce market.

The distribution of livestock is dominated by goats, poultry and cattle. There is a significant level of dairy farming and the land holding for dairy farmers is around 23.75 hectares (COK development strategy 2002).



Fig.2.16 Existing Agricultural Areas Map





Fig.2.17 Environmental issues in Kigali : Erosion





ISSUES & CHALLENGES

- High population density on the limited land resource puts pressure on agricultural productivity. This has led to land fragmentation & reduction of farm
- Intensive and over cultivation of land without restoration of soil nutrients. lack of appropriate farming practice and research services.
- There is increasing soil erosion & vulnerability to climatic shocks like drought or heavy rains.
- There is dependency on rain for irrigation.
- The use of fertilizers and agricultural chemicals has polluted water; soil and mismanagement of the wetlands have further degraded and destroyed them.

RWANDA LANDUSE MASTER PLAN - VISION 2020

The modernization of agriculture is considered one of the six pillars of vision 2020. It aims to transform Agriculture from subsistence to a productive high value; market oriented farming that is environmentally friendly and has an impact on other sectors of the economy.

The plan of action focuses on four priority programs:

- 1.Intensification and development of sustainable production systems
- 2. Support for producer professionalization 3. Promotion of product chains and agro-
- industry development 4. Institutional development

GOVERNMENT STRATEGIES AND PROGRAMS

Based on the above mentioned priority programs, several agricultural management and improvement projects

are in progress, such as; the Land Tenure Reform Program (Immudugudu Village) to allow intensification and mechanization of farm land. Production of export oriented agriculture such as soya bean sericulture, flowers, seeds etc. along the marshlands near the Kanombe International airport. The construction of silos and treatment plant in Kigali Special Economic Zone (KSEZ) in Gasabo District is a part of Rwanda Post Harvest Handling and Storage (PHHS) program. MANGRI is also promoting farmers to produce high value crops such as mushrooms, fruits, vegetables and practice horticulture. Moreover a holistic agriculture, environment and irrigation management strategy needs to be formulated and managed at the city scale rather than the piecemeal solutions. The Kigali City should consider urban agriculture, a survival strategy for middle and low-income population and transform farming from subsistence to a marketbased enterprise.

2.6.6 FORESTRY

The forestry sector plays a key role in supporting the livelihood of the suburban population by providing food, medicines and energy, controlling soil erosion and protecting water catchments and supplying other goods and ecological services.

In Kigali City natural as well as man-made forests cover a total area of 8242 ha. Natural forests in the city are available in small scattered patches as a result of urban development and deforestation due to pressures of subsistence farming. In addition to these forests, according to F.A.O definition of forests; there are other forest resources consisting of small wood lots (with an area of less than 0.5ha) and other trees outside forest (generally referred to

as agro-forestry trees).

Within the city natural forests are owned and managed by the central government, where as the forest plantations are owned by private as well as district government. They are mainly dominated by eucalyptus trees. The common trees used in forest plantations are for fuel wood, construction poles and timber are Grevillea robusta, Eucalyptus sp., Vernonia Amygdalina, Euphorbia tirucalli, Cupressus, Acanthus Pubescens, Ficus Thonningii, Euphorbia Tirucalli etc. and the food, fruit and spice plantation is dominated by Persea gratissima, Psidiumguajava, Coffee, Capsicum frutescens, Caric, Banana and Papaya trees.

ISSUES & CHALLENGES

- Mostly the agro forestry is happens along steep slopes greater than 15% without proper soil stabilization methods. In low-lying areas, pressure for agricultural space has led to inappropriate marsh cultivation.
- At higher elevation areas, deforestation has played a key role in decreasing the ability of watersheds to catch and restore water.

GOVERNMENT STRATEGIES, CONSERVATION AND MANAGEMENT EFFORTS

• Vision 2020 and EDPRS set clear targets to increase national forest cover by up to 30% and for the forestry sector to play an increasing role in the national economy. However, due to the increasing urbanization in the Kigali City farming land per household is shrinking. There is also high competition for land between forestry, agriculture and other developmental activities.

- In current forestry projects there is no control over the types of plantations or environment management guidelines. Also in the district forest lands, the projects are approved on case by case basis depending on the objectives established by community organizations and NGO's.
- Forest conservation and management strategies are governed by the Forestry Law which is currently under modification.



Fig.2.19 Existing Forests Areas Map



2.6.7 LAND AVAILABILITY FOR DEVELOPMENT LAND EXPLOITATION

Currently Kigali is facing increasing urbanization and heavy development pressure. The population in Kigali and other urban centers has almost doubled since 1991, and this has drastically increased the demand for housing and other urban services. This poses a negative impact on the environment and natural resources. Only the city centre area is relatively urbanized with rapidly new suburban areas growing at the periphery.

Kigali City is built on the interlocking hills, which progressively converge, and are separated from each other by valleys and wetlands. The slope analysis map (Refer Fig.2.10) indicates that 22273 ha land has more than 20% slope which is not suitable for development. These land will most probably have to be dedicated for agro forestry, forest plantation and steep slope conservation zone.

The water bodies watershed and drainage map Fig.2.11 indicates 291.6 ha land is occupied by water bodies and the large number of natural drainage channels which collects the water from respective watershed areas and drains into Nyabogogo and Nyaborongo Rivers. These natural drains plays important role in the storm water management of the city and have to be conserved along with the water bodies in the proposed Master Plan which can be further used for parks.

The wetland map Fig.2.12 indicates that 4967.7 ha land is occupied by wetlands, existing along the low lying valleys adjacent to the rivers. The wetlands in Kigali City are protected by law and no development

activities are allowed within these zones. The proposed Master Plan will identify strategic locations along the wetlands which can be used as parks and recreation areas along with environmental conservation and agriculture.

The Forest map Fig.2.19 indicates that 8242 ha of land is occupied by natural and manmade forests which can be conserved and linked to biodiversity corridors.

The map indicating land available for development (Fig.2.20) combines all the natural constraints within the Kigali City discussed above. 50% of the 731 km² in Kigali City is occupied by wetlands, water bodies, forests and mountains, with more than 20% slopes and other natural obstacles. The remaining 50% of the area can be considered suitable for development.

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2.7 Built-up areas & key urban developments

The urban built - up areas cover 17% of land within Kigali City, of which almost 54% of land is occupied by residential uses. The remaining is occupied by other employment areas and supporting infrastructures. Some of the key existing urban nodes and urban developments are shown in Fig.2.21 and Fig.2.22 respectively.

2.7.1 KEY URBAN NODES

COMMERCIAL NODES

The existing Kigali City Centre (KCC) at Nyarugenge is the major regional commercial node in the City. The former proposal for CBD identified the areas of Muhima to be integrated and redeveloped as part of CBD, of which Phase 1 development covering 33 Ha is currently being developed. The existing pattern of commercial development indicates finger-like growth of commercial activities along the Boulevard De L' Umuganda from the City Centre towards the Airport with significant clusters around the KBC ¹Roundabout, Gishushu, Gisimenti and the airport west junction. Majority of these commercial developments include clusters of government and non government offices, hotel, eateries, banks and supermarkets.

Other significant commercial nodes inlcude Kimironko, Gakinjiro, Mulundi, Kabuga and Rugende markets within the urban residential areas mostly catering to local needs of the residents. Some of the rural settlement areas are found to be served by smaller market centres. There are no designated regional commercial nodes around the City currently. As such this needs to be addressed in the city master plan.

RESIDENTIAL NODES

Kigali's residential areas are spread over 17 urban sectors which include Gatsata, Gisozi, Remera Kimironko and part of Kinyinya in the Gasabo District; Gikondo, Kicukiro, Niboye, Kagarama and northern parts of Kigarama, Kanombe and Nyarugunga sectors in Kicukiro District; and Gitega, Kimisagara, Nyakabanda, Rwezamenyo and parts of Nyamirambo sector in Nyarugenge District.

Most of these residential nodes are in the immediate areas around the CBD and constitute large unplanned high density residential areas. The planned residential developments comprise of medium and low density detached single family landed homes and of few recently developed clustered housing estates that can be found in Gaculiro and Gapocho.

Newer residential areas in urban areas are largely focused in Gasabo district in Kinyinya, Gisozi and parts of Ndera and Rusororo sectors along the EW regional road. The current trend of low and medium density developments is not sustainable in the long run and requires suitable density management strategies to promote a compact living environment. Majority of land with higher density potential is occupied by low and medium density developments. Development potential of these site needs to be capitalized upon.

In addition to the urban residential nodes, 47 rural estates called Imudugudus are planned around the City to organize scattered rural settlements and to provide



18 1 Kigali Business Centre

DISTRICT PHYSICAL PLANS FOR KICUKIRO AND GASABO, KIGALI, RWANDA



relocation shelter. Imudugudus planned in the rural area needs to be further consolidated into clusters of medium density housing. Existing Imudugudus within urban expansion areas could be redeveloped to tap on the potential of the site.

While the housing market caters to the needs of a few privileged groups, housing needs of large group of people in the lower income brackets remains a pressing issue and needs to be urgently addressed. Table 2.5 Approved Residential Development

RESIDENTIAL DEVELOPMENT	HOUSING TYPE & UNITS	
EMERALD INVEST- MENTS , GISOZI DIPLOMATIC ZONE	600 Apartment Units 200 Villas	
GACULIRO	1000 VILLAS 1600 Apartment Units	
CO.C.VAM ESTATE, CYARUZINGE	1025 VILLAS	
Nyagahanga	VILLAS 10000 UNITS ?	
Real Contractors, Kinyinya	300 Apartment Units	
Idem, Kiyovu	120 VILLAS	
Idem, Kagugu	54 Apartment Units	
Kigali Top Moun- tain, Kagugu	60 VILLAS	
DN INTERNATIONAL, RUSORORO	150 Units	
OLIVE PROPERTIES, GACULIRO	36 Apartment Units	
Ujenge Rw Ltd, Kagugu	172 APARTMENT UNITS	
PYGMA GROUP, KAGARAMA	64 Apartment Units	
Kicukiro-Rukatsa Housing	120 Apartment Units	

INDUSTRIAL NODES

Currently, the largest industrial cluster in Kigali is sited in Gikondo on and along the wetlands. Hence, the City is in the process of relocating these industries to the Phase 1 development of newly designated Kigali Free Trade Zone (FTZ) north of airport. In addition to the proposed relocations of the industries in Gikondo industrial area, the current Magerwa Dry Port also requires a suitable area for relocation.

The Kigali FTZ is proposed to accommodate light industries, medium industries, heavy industries, warehouses, commercial centres, ICT Park, and lorry park, etc. As per the current FTZ plan, the three phases of FTZ are not contiguous and there is a potential to form a compatible and contiguous cluster of industries in the land between Phase 1 and Phase 2 area.

Another cluster of industries include a petroleum storage, chemical and other heavy industries which are located in Gatsata along the Kigali - Gatuna Road. Further to this, some scattered industrial developments can be found along the eastern stretch of airport road that needs to be consolidated.

2.7.2 SUB-AREAS PLANNING PROJECTS

The City has undertaken several local area specific planning studies in the last few years, most of which are completed and require careful examination before integrating it to the new City Concept Plan. These projects are indicated in Fig.2.22 and includes detailed Master Plan for Nyarugenge District and CBD; and the Sub Area Plans for Kimihurura, Kinyinya, Rebero and Masaka prepared in 2010.

NYARUGENGE DISTRICT MASTER PLAN (134 SQ KM)

Planning Proposal :

- 1,000,000 Population, 5 Compact and Integrated Townships (200 DU / Ha)
- Revitalized and expanded CBD (894 Ha)
- 2,000,000 sq m commercial space in CBD
- Detailed zoning guidelines
- Building height of upto 16 stories in residential areas and upto 30 in CBD

Single Family Real Lore Rise Real High Rise Real Commercial Office Commercial General Real-Reversation Commercial General Real-Reversation District Bounda District Bounda

KINYINYA TOWNSHIP AND TOWN CENTRE (205 HA)

Planning Proposal :

- 11 Neighborhoods (8000 DU, 30000 population & 11 NC) Mixed Use, Civic Center, Education Complex and Social– Cultural Amenities
- 200,000 sqm commercial space
- Building Height of 2 to 10 stories

Kimihurura Sub Area (89 Ha)

Planning Proposal :

- 800 DU Residential
- High-Density MU Commercial Center
- 1500 Hotel Rooms
- 220,000 sqm commercial space
- Building Height of 2 to 10 stories





Rebero Sub Area (76 Ha)

Planning Proposal :

- 500 DU Residential
- Resort & Conference Centre
- 1400 Hotel Rooms
- 10,000 to 15,000 sqm commercial space





Planning Implications :

- The District Master Plan needs to be integrated and reviewed based on the City Concept.
- The CBD is not able to achieve the proposed skyline based on upper limits of zoning guidelines. The demand for commercial space may be there but the local investors are under capable to fully optimize the commercial potential of the parcels in CBD Phase 1. Hence, the guidelines need to be reviewed.

Planning Implications :

- Civic uses such as Government and Non government agencies could be strengthened around existing civic nodes at Kimihurura and Kacyiru.
- There is a need to redefine high and medium densities. The development potential of the site needs to be capitalized for much higher density.
- There is a need to contextualize the proposal based on existing road alignments.

Planning Implications :

- There is a potential to strengthen the Civic node.
- High and medium densities need to be redefined and untapped "Location Potential" needs to be capitalized for much higher density (ie. 15 – 20 Stories or more)
- There is a need to contextualize the proposal based on existing road alignments.

Planning Implications :

- There is a potential to strengthen Rebero Area as a tourism destination by introducing recreational Thematic Park.
- There is a need to contextualize the proposal based on existing road alignments.

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MASAKA SECTOR SUB AREA (45 SQ KM)

Planning Proposal :

- 290,000 Population, existing Masaka Town & 4 new towns
- New Masaka Cultural Centre, Medical/ Research Center and a light industrial Innovation Center
- Building Height of 2 to 10 stories



Planning Implications :

- The location of the site offers the potential for logistics which could be capitalized.
- The high and medium densities needs to be redefined and untapped "Location Potential" needs to be capitalized for much higher density.
- There is a need to contextualize the proposal based on existing road alignments.



2.8 Housing & Community Setting

This section presents different housing typologies that can be found in Kigali and discusses some of the housing issues and recommendations for the affordable housing.

2.8.1 ISSUES ON HOUSING IN KIGALI

About 9% of existing built up areas is under residential use. 7% of residential areas in the City are covered by unplanned area and accommodate 78% of the current City population.

Some of the key issues regarding the The present situation of housing sector in Kigali are:

- Growing Informal Settlements.
- Relatively high costs of land, construction materials, and labor
- · Limited financial resources and loans for housing
- Scarcity of planned land in major towns supplied with infrastructure for housing
- Shortage of locally produced building materials
- Poor utility and water supply services
- · Lack of maintenance and management of housing compounds, apartment houses and high-rise buildings.

Single Family Residential Low Rise Residential Medium Rise Residential



Fig.2.24 Unplanned slums (top left), unplanned lowrise residential (top right)

2.8.2 HOUSING TYPOLOGIES

Housing typology in Kigali today, can be classified into two broad groups- high density packed unplanned housing and planned housing which is usually in the form of low density or single family homes.

UNPLANNED SLUM AREAS

The unplanned category can be further categorized into three types - unplanned slum areas with limited access to facilities and poor living conditions, unplanned low rise residential within urban areas which can be characterized as the urban conglomeration resulted due to lack of service lands around the City Centre and the unplanned residential in the rural farmlands which can be found in the peripheral parts of the City.

Few slum settlements can be found around the City Centre in Kigali. Especially the ones located at Urukondo are in very poor conditions with 4-8 people living in the plots as small as 10-15 sq m. These areas have limited connection to electricity and very poor access to sanitation services with one latrine shared by 20-40 household. Due to the poorest urban environment, these areas require priority redevelopment schemes with proper housing relocation programs. As a result of low income capacity, the density of these areas are

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much higher than some of the planned housing areas. Hence, the redevelopment proposals for these areas have higher potentials for compact development.

UNPLANNED LOW RISE RESIDENTIAL IN URBAN AREAS

The unplanned Low Rise Residential are the most predominant typology of houses located in Biryogo, Nyamirambo, Kimisagara and Gatsata neighborhoods. These houses sit on 200-250 sqm plot sizes and are largely wood and mud finished with 2-3 bedrooms and 1 or 2 pit latrine with electricity and piped water supply. Similar to unplanned slum areas, these sites are densely populated and poses a higher potential for compact development. Some of these areas with local character may be retained as conserved neighborhoods with improved urban services. UNPLANNED LOW RISE RESIDENTIAL IN RURAL AREAS Almost 50% of Kigali City is occupied by farmlands with unplanned scattered rural housing. These houses are generally very low density and built on the large plots of farm. As a national strategy set in Rwanda's Vision 2020, the government looks at consolidation of these rural housing as planned rural estates, also called Imudugudus.

PLANNED SINGLE FAMILY VILLA

The age old culture of farming and living on the landed property has led to the development of sprawling low density single family housing in prime urban area like Kigali. The issue is further compounded due to lower land value and lack of long term growth plans for the City. As a result, there are many single family villas in Kigali. Most of these planned villas are located around the central parts of the City such as Remera, Kimihurura, Kibagaga, Gikondo and Kimisahge areas.



Planned Single Family Exclusive Villa



Planned Multi Family Low Rise Apartments

PLANNED SINGLE FAMILY EXCLUSIVE VILLA AREAS

In contrast to the large unplanned areas with poor living conditions, there are some high class landed properties in the City around Nyarutarama, Gaculiro, Kiyovu (old City) and Kagarama at Kicukiro district. These houses are developed in the planned areas with proper serviced roads and accessibility to other key urban infrastructure.

PLANNED MULTI FAMILY LOW RISE APARTMENT

There are few multi-family low rise apartments developed recently in Kigali. Some of these units can be found in Kacyiru developed by the Rwanda Social Security Board and at Kagugu developed by Ujenge RW Ltd. as a private development. These apartments are generally 2-3 storeys high with 2-3 bedrooms and are targeted generally towards the expatriates. These units are sometimes developed as a small component within the larger housing estate with proper infrastructure services.



Planned Multi Family Medium Rise Apartments



Planned Estate Housing



Similar to the low rise apartments, there are only handful of multi family medium rise apartments in Kigali. The significant one at Kacyiru is 2-3 rooms apartment and 6-8 storeys high which is also developed by the Rwanda Social Security Board. Currently, this is the highest residential development in Kigali and is targeting mainly the high income households.

PLANNED HOUSING ESTATES

There are recent trends of cluster housing found in Kigali offering multiple choices of housing units in the form of larger estates. Most of these housing estates are located in the outskirts of the city and are private developments in large plots of land. Some of these developments are located in Kabuga, Gisozi (by Rwanda Social Security Board), Gaculiro and Kinyinya. Majority of the dwelling units within these Estates are 3-5 room G+1 villa on 500-600 sqm plots.



Planned Government Housing



Planned Imudugudus

Unplanned Low Rise Residential in Rural Areas

Planned Single Family Villa Fig.2.25 Housing Typologies of Kigali

PLANNED GOVERNMENT HOUSING

As an example of low cost government housing, there are around 250 affordable units planned in Bhatsinda. The housing is serviced with basic access road and some other infrastructure facilities such as central water point. Although, it is a commendable initiative of housing for the low income group, the low density typology is not sustainable in the long run to meet the City's large demand for affordable housing.

PLANNED IMUDUGUDUS

Planned Imudugudus are the cluster of village communities developed to consolidate rural sprawl as well as to provide post genocide housing. There are approximately 3000 such units mainly in the rural areas of Kigali. The houses are made of temporary building materials and have basic services such as common water supply point and electricity but has poor access to other urban amenities.

2.8.3 OVERVIEW OF HOUSING STUDIES FOR KIGALI

Multiple studies have been conducted in relation to housing by various international and government institutes. All these have been invaluable in understanding the housing issues of Kigali.

WORLD BANK HOUSING RESEARCH

A qualitative research was conducted by the World Bank in order to assess the housing conditions in the City of Kigali. The research focuses on the understanding of the urbanization and housing needs for the City and highlights the current housing market, the stocks supplied, the gaps between the affordable housing supply and the recommendations for the City.

HOUSING MARKET

Housing affordability, is the most pressing issue in Kigali. Only a very small group of people earning RF 1.5 M per month and above could afford a formal house. As a result of low household income compounded with relatively high cost of living; the vast majority of Kigali's population live in informal settlements occupying area as large as 62 percent of the City's land, housing 83 percent of the City's population. The informal settlements are home to not just the poor who live there, but also most of the middle income earners - HH income RF600K-RF1.5M/m (\$1000-2500). Formal sector housing in Kigali is occupied by less than a fifth of the City's population. Majority of these formal sectors are single family houses, and some condominiums (built by housing cooperatives or developers), most of which are purchased as investment property for either rental or speculative purposes. Typically priced at RF 50M upwards for 2 bedroom apartments/ condominiums & ranging up to RF130M for a 5-8 Bedroom villa (estate housing – single family), these houses can be afforded by only the top 2-5 percent of the income earners. Due to this trend, peri-urban areas are becoming increasingly occupied by the low and middle income households who are previously living in Kigali city and have either been bought out or chosen to move to the outskirts because of high cost of construction or home improvements.

AFFORDABILITY GAP

Kigali faces an acute housing shortage in the formal housing market and there is a huge existing demand as well as the growing needs that requires to be addressed in term of housing provision. This applies

even to those in the middle and upper income tiers, including those earning RF 250K-RF1.5M per month who could afford a house costing RF15M-30M.

There are several issues attributed to the supply of formal sector housing and housing finance:

- High cost of construction due to expensive construction materials.
- Limited capacity of developers.
- Low rise and large single family housing.
- Interpretation of the Master plan's zoning and building standards as the 'minimum' has frozen the housing market.
- High cost of construction loan and financing.
- · Given the low levels of income, there is limited access to financing.

KEY STRATEGIES AND RECOMMENDATIONS

- Reduce costs of construction to increase affordability, by using 'Green' technologies and alternative materials, and lower standards to promote consumption of lesser built-up space.
- Promote high density, low-rise developments that better achieve the desired cost and space efficiencies.
- Ease regulations in a way that allows people to build/ improve their structures incrementally, without compromising the structural safety standards.
- Find innovative ways to enable both developers and individuals to access financing at affordable rates.
- Provide housing micro finance/ home improvement loans as it eases the housing market, given that the bulk of the housing in Kigali is self-built.
- Provide construction loans to people building homes outside of the city but

with caution for rampant and rapid sprawl, which may have negative implications on the efficient growth of Kigali city.

PLANNING IMPLICATIONS

- The study presents the overall gualitative assessment of affordability of formal housing for different income groups with some of the general recommendations that can be followed through while developing the new City Master Plan.
- There is a need for a more in-depth quantitative housing assessment to analyze the requirements of different types of housing stock for different income groups at least for the short term of 5-10 years based on the affordability criteria, estimated demands from future city population and the existing unmet demands.
- The new City Master Plan will require to make provisions for a rational share of housing types offering choice of homes for all the income brackets.
- The new City Master Plan also needs to provide strategies for improvement of informal slums and redevelopment of unplanned areas. Certain unplanned settlements with strong local character could be identified as conservation area to retain local and historical value.

HOUSING IN KIGALI INFORMAL HOUSING SURVEY 2007 REPORT

The study looks into the mechanisms of the infromal housing market in Kigali. It is focused on the following information, including their interrelations, within the non-registered

housing sector:

• General information about the owner or tenant family

- Tenancy and ownership relationships and status
- Housing typologies and costs
- House construction types, construction process, and financing and purchase mechanisms

HOUSING OWNERSHIP & RENTAL

In Kigali about 17% of houses are in good state with formal title plots. An informal estimate is that 78 % of the City's population live in informal settlements. While most owner-households (84.5%) do not rent out any portion of their house; most landlords own more than one house or housing



Fig.2.26 (top) Zones used for Survey; (top left) Household income per month by occupancy status (bottom) monthly income in tenant households by zone. Source: Housing in Kigali, Informal Housing Survey 2007 Report, Kigali City - RISD - DED 2008

unit and rent them to other tenants. Rent costs vary considerably depending on the location in relation to the city center. Rent is much lower in the rural peripheral areas of Kigali, and maximum rent prices are found in the city fringe areas which offer a higher variety and availability of rental units.t is seen that in the lowest income category there are more house owners than tenants. Majority of the people living in the city areas and city fringe areas fall in the category with monthly household income of 50.000FRW. It is also observed that tenant households of the highest income range (100.000FRW - 250.000FRW) live in the central city areas. (refer to Fig.2.26)

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AFFORDABLE HOUSING DEVELOPMENT (RWANDA HOUSING AUTHORITY)

This project highlights the housing challenges in Rwanda and confer the enabling strategies and operational instruments that need to be put in place to achieve the vision of 'housing for all'.

Similar to the findings from world bank housing assessment, this study highlights the pressing issues of affordability for both low and mid income earners. The houses available on the market are built with primary objective of maximizing profit. The table below illustrates the average monthly earning or salary of an ordinary Rwandan with a 16% interest rate for the average mortgage to pay off in 20 years. The study indicates that existing housing shortage is only expected to increase in the near future if enabling strategies and operational instruments are not established.

RECOMMENDED GOVERNMENT INTERVENTION

• Formulate Affordable Housing Policy on the lines of National Urban Housing and

Table 2.6 Average Monthly Earning and Mortgage

Human Settlement Policies; following consultation on housing demand and needs assessment considering location, type and size of housing required.

- Plan and provide housing alternatives for low income families by investing in land acquisition near facilities, utilities, amenities and services or by expropriating raw land without services which shall reduce the cost.
- Avail social and economic infrastructure in un-serviced sites to reduce the cost for developers for developing the affordable housing.
- Provide Tax exemption on imported construction materials to reduce the construction cost and make it more affordable.
- Set up a private sector led affordable housing provision with 25 to 30% of affordable housing units in new housing developments.
- Create National Mortgage Guarantee Fund through financial support of central government and municipalities.
- Encourage housing finance schemes through micro credit cooperatives for the low income/ poor households.
- Provide Government funding and

Approx. Net Salary (RwF)	MAX. MONTHLY R e p a y m e n t (RwF) [30%]	INTEREST RATE (%)	Repayment Period (years)	Max Loan Amount affordable (RWF)
700,000	210,000	16%	20	15,100,000
600,000	180,000	16%	20	13,000,000
500,000	150,000	16%	20	10,750,000
300,000	90,000	16%	20	6,500,000
200,000	60,000	16%	20	4,300,000
100,000	30,000	16%	20	2,200,000

subsidies.

 Negotiate with Social Security Board such that the contributions by all employees become the security of obtaining mortgage loans from financial institutions or social security funds to finance the payer's housing.

As a pilot project, Rwanda Housing Authority is exploring different affordable housing models for government employees. Based on the needs assessment, around 70% of the respondents preferred the units between 60 - 100 sqm with larger demand for 3 bed room individual houses. Two sites have been identified at Murama and Gisozi for the development of 400 affordable housing units. The proposed Models comprises of duplexes and 3-5 storey apartments with 1-3 bed rooms. The housing prices range from 5.5 Mil RWF for 1 bed room apartment unit to 24 - 43 Mil Rwf for 3 bedroom apartment units.

PLANNING IMPLICATIONS

- While the affordable housing project is a good initiation to address the housing needs of government employees, it is important to note that this group of earners are still the well to do category in terms income bracket. The needs of lowest income brackets require to be addressed in the similar manner.
- The project explores the medium low density apartments for the pilot project. In order to meet the much larger demands, the affordable housing models can be provided with much higher densities to achieve the optimal yield on the government land.

HOUSING MARKET DEMAND, HOUSING FINANCE, AND HOUSING PREFERENCES FOR THE CITY OF KIGALI (EUROPEAID)

The study was funded by EU for the City of Kigali, RHA / MININFRA and MINECOFIN to estimate the demand and supply of housing in Kigali. taking 2012 as the baseline year the study projects the housing needs of the city for the next 10 years, or until 2022. It also proposes a housing typology and housing finance mechanisms to meet demand, especially for affordable housing.

EXISTING HOUSING STOCK

Based on information provided by EICV3, of the 223,000 existing DU in Kigali, there are 108,803 DU that need to be replaced due to overcrowding and low-quality. The remaining 114,197 DU are split into housing in good condition (42,710 DU) and housing to be upgraded (71,487 DU). Housing to be upgraded is calculated assuming that 62.5% of remaining DU are units in informal settlements. (Refer Table 2.7)

HOUSEHOLD INCOME

The study breaks the income category into 5 Quintiles. 81% of the households falls within the the lowest income bracket (Q1) earning upto 300,000 RWF per month. Within this approximately 55% earn less than 100,000 RWF. 11% of the households fall in Q2 earning between 300-600,000 RWF. (Refer Fig.2.27)

As per the studies findings, most new houses cost as much as more than 10 times the annual family income in the lowest income group. (UN literature indicates that households are capable of affording only 2.5 times the annual collective income.)

Source: Affordable Housing Development, RHA

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Table 2.7 Kigali Housing StockSupply

	Assessment of Existing Housing Stock (2011)	DU	%
1.1	Good Condition	42.710	19,15%
1.2	To be Upgraded	71.487	32,06%
1.3	To be Replaced	108.803	48,79%
	Totals	223.000	100,00%

Source: Housing Market Demand, Housing Finance, and Housing Preferences for the City of KIGALI, EuropeAid



Fig.2.27 Kigali Baseline Income Segmentation Source: Housing Market Demand, Housing Finance, and Housing Preferences for the City of KIGAU, EuropeAid

HOUSING DEMAND

Total housing requirements in Kigali by 2022 are projected to be 458,265 dwelling units. These requirements could be met by maintaining part of the existing housing stock that is in good condition or upgradeable (114,197 DU) plus building of new dwellings (344,068 DU). Thus, the new housing demand is estimated to be 344,068 DU which need to be developed between 2012 and 2022. (Refer Table 2.8)

The four different categories of housing have been identified as social housing, affordable housing, midrange housing and premium housing according to household income and financing.

2	New Dwellings (including backlog) to be built 2012-22	DU	%		Monthly	% of
2.1	Social Housing	43,436	12,62%	Description	income (HWF)	Population
2.2	Affordable Housing	186.163	54,11%	Mid-range Housing	900,00 <	3.77
2.3	Mid-range Housing	112.867	32,80%	(mortgage finance)		
2.4	Premium Housing	1.601	0,47%		200,00 - 900,000	29.5
Subtotal B	(2.1 + 2.2 + 2.3 + 2.4)	344.068	100,00%		and the second s	fatore in the second of
	Meeting Housing Needs in	-		Affordable Housing (Rent-to-own and other francing)		
3	Kigali 2012-22	DU	%		33,500 -	
Subtotal A	Existing Housing Stock	114.197	24,92%	Social Housing	200,000	54.11
Subtotal B	New Dwellings	344.068	75,08%	(Subsidy)	< 33,500	12.62
	Total	458.265	100.00%		· Some and the second second	

Table 2.8 Kigali Housing Demand 2012-22

Source: Housing Market Demand, Housing Finance, and Housing Preferences for the City of KIGALI, EuropeAid

Table 2.9 Kigali Housing Demand 2012-22 by income group

Quintile		Monthly HH	Income RwF		Total DU	
	Segment	From	То	TOTAL DU	Quintile	Proportion
	1	<	100.000	147.761	1	Part and
	2	100.001	200.000	81.838		
Q1	3	200.001	300.000	39.266	268.865	78%
	4	300.001	400.000	22.914		
	5	400.001	500.000	14.100	1.00	
Q2	6	500.001	600.000	9.225	46.239	13%
	7	600.001	700.000	7.035		
	8	700.001	800.000	5.147	1999 6.4	10.00
Q3	9	800.001	900.000	3.627	15,809	5%
	10	900.001	1.000.000	2.599		
1.1	11	1.000.001	1.100.000	1.987		
Q4	12	1.100.001	1.500.000	3.669	8.254	2%
1.0	13	1.500.001	2.000.000	2.193		(F
11.1	14	2.000.001	2.500.000	1.107		1
Q.5	15	2.500.001	<	1.601	4.901	1%
		2	TOTAL DU	344.068	1.	

Source: Housing Market Demand, Housing Finance, and Housing Preferences for the City of KIGALI, EuropeAid

SUPPLY

The formal housing market, as it is currently operating, supplies around 1,000 DU per year, but the city will demand around 31,000 DU per year. Therefore, approximately 30,000 DU must be supplied through other mechanisms: increased formal market supply, some combination of formal pubic-private partnerships, or the informal market. The strategy mix for housing solutions will reflect a variety of different factors, and the combination of more than one solution may be required to address housing needs in Kigali.

Supply of new housing could be accomplished in three general ways:

- Through the market, using banking and mortgage finance
- Through special programs and incentives or other innovative means for reaching households that currently pay rent but do not qualify for mortgage finance (for example, rent-to-own)
- Through policies for subsidizing housing provided by the government.

In the lowest income quintile (Q1), where households earn RWF 300,000/month and less, 12.62% corresponds to social housing, and 54.11% of new demand corresponds to affordable housing. Both social and affordable housing require some government support, ranging from full subsidy to special programs and incentives. The remaining 33.27% of housing demand can potentially be covered by market financing. This includes the highest level of Q1 (segment 3, 11.27% of the households), plus mid-range and premium housing demand in Q2 to Q5.1

PLANNING IMPLICATIONS

- The study presents a detailed assessment based on affordability of housing for different income groups with recommendations for housing segments that can be followed through while developing the new City Master Plan.
- The new City Master Plan can help to determine the various landuses and zoning categories based on the housing demand studies.
- The new City Master Plan also help develop strategies for improvement of informal slums and redevelopment of unplanned areas based on the the recommendations of the report. The housing typologies presented in the study can help to guide the development of the various housing categories for the City Master Plan.
- The study projects housing needs in the immediate term upto 2022. The new City Masterplan is being prepared for the next 30 years and would build on the recommendations of the study.

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¹ Housing Market Demand, Housing Finance, and Housing Preferences for the City of Kigali

2.9 Social Infrastructure Provisions

At the city planning level, social amenities includes major sport & recreational facilities, medical and educational establishments. For physical planning purposes, the provision of social amenities largely deals with space provision and safeguarding and securing land for these facilities. This section examines the key social infrastructure at the regional level in terms of their existing condition, gaps and recommendations.

2.9.1 Education Facilities

INSTITUTIONAL ARRANGEMENT

One of the pillars of Vision 2020 for Rwanda is to develop a comprehensive human resource. A long term qualitative and modern educational system is vital to the city in achieving this goal. The Rwandan constitution ensures basic education as a principal right for all citizens and offers it for free. The Ministry of Education is the key body which provides the guiding policy for all levels of education in Rwanda.

There is a bid to fight against illiteracy and ensure Literacy rate in the city of Kigali is 86.5% which is much higher than the

national average of 69.7%.¹ The education system in Rwanda consists of two levels, the mandatory level and the voluntary level. The mandatory level consists of nine year basic education which is compulsory for all citizens. This level consists of the six years of primary education and three years of lower secondary education. The voluntary level consists of three years of upper secondary education followed by four years of tertiary education. The age group distribution shows that the demand for education is high in Rwanda since a large population is comprised of youngsters between 0-19 years. Pupils/classroom in primary schools is targeted to be 52 in 2012. According to the quality standards by MINEDUC 2009, pupil/teacher ratio should be 1:46. The pupil to classroom ratio is currently 73: 1 for primary and 45:1 in secondary.²

PRIMARY EDUCATION

With the introduction of universal primary education, the net enrolment rate has increased to 94.2% (2008) in Rwanda. As per the National Land Use Master plan projections, there will be higher demand for compulsory schools i.e. the first nine years of school for age group 7-15 due to a larger population of children than in

1	EICV3
2	RNLUMP

Table 2.10 Rwanda Education System

RWANDA EDUCATION SYSTEM				
MANDATORY VOLUNTARY				
PRIMARY EDUCATION	LOWER SECONDARY	Upper Secondary	Tertiary	
6 years	3 years	3 years	4 years	

Source: National Land Use Masterplan





the working age group. Currently there are 175 primary schools in Kigali, with 163483 enrolled students. There are 62 schools in Kicukiro, 79 schools in Gasabo and 34 schools in Nyarugenge.³ As per the standards set by the Ministry of Education, the standard walking distance between the primary schools should be at a maximum distance of 5 km. However, the National Land Use Masterplan has proposed that the distance between the primary schools to be maintained at 2 kms. A provision standard was developed as part of the Nyarugenge Detailed Physical Plan (NDPP), as per which one primary school was to be provided per 15000 people. The minimum provision set for a primary school was to 1.5 ha. Due to the high demand, there currently is a short fall of primary schools and the existing schools area also overcrowded.

SECONDARY EDUCATION

The enrolment rate for secondary education is relatively low as compared to primary schools. Currently there are 110 secondary schools in Kigali City with over 49000 enrolled students. As per the standards set by the Ministry of Education, the standard walking distance between secondary schools should be 5 kms. However, the RNLUMP plan proposed that the distance between the primary schools to be maintained at 3 kms. As per the NDPP, one secondary school was to be provided per 25000 people, and the minimum area for a primary school is to be 2.4 ha. Wherever appropriate a combination of primary and secondary school should be allowed which would have a combined catchment of 25000 people. The space provision for such a combined school was 2.8 ha. With he projected rise in secondary enrolment , there will be shortfall of secondary schools in Kigali in the near future.

TERTIARY EDUCATION

Currently there are 31 tertiary education facilities in Rwanda which provides education to over 73000 students in 2011 as compared to around 55000 in 2009. Of these tertiary institutes, 14 are private institutes and 17 are public. A majority of these tertiary institutes are located in Kigali City, resulting in a lot of young people having to migrate to Kigali to pursue higher education. As per the provision standards prepared for NDPP, one Vocational/ ICT institute of 5 ha was to be provided per 120000 people or 1 per township. Similarly, higher education institutes like a university would be provided per 500000 inhabitants. Each such institute would provided with 6 ha of land. There is a also a high demand for tertiary education institutes in Kigali currently represented by the number of new higher education institutes coming up in the city. For Rwanda to be a knowledge economy, it will be necessary for more tertiary institutes to produce quality skilled and educated workers.

2.9.2 Health Care Facilities

The government's health sector development strategy is based on decentralized management and district level care. Health services in Rwanda are provided through the public sector, government-assisted health facilities (GAHFs), private health facilities, and traditional healers.

³ MINEDUC Department of Statistics 2011

Fig.2.29 Existing Health Care Facilities Map

The public sector has two main categories the secondary health centers and primary health centers. The secondary health center consists of referral hospitals with a catchment at a national level and the district hospital caters to the district population. The primary health centre consists of health centers at sector level, military/police hospitals, prison hospitals, privately run polyclinics, dispensaries and health posts.

To ensure efficient health care coverage, health care norms were established in 1997. As per these norms, a district level hospital would have coverage of 200,000 people. Similarly, one health centre would be provided per 20,000 people. As per the Ministry of Health's standards, the minimum walking distance between Health Centers should be 5km which should not take more than one hour walking distance. The standard number of beds in Rwanda for any admitting health facility is 1 per 1000 inhabitants. As per the RNLUMP, this number is not sufficient and has provided a standard of 5 beds per 10000 inhabitants. As per NDDP, one health centre was to be provided per 15000 people which would be part of the neighborhood centre having a minimum area of 0.5 ha. Similarly one polyclinic would be provided for a catchment of 120,000 (or township) with an areas of 5 ha. Regional hospitals of 5 ha would be provided per 500000 inhabitants.

Kigali being the capital city enjoys a good distribution of health facilities. As of 2010, there are 3 Referral hospitals in Kigali, 4 District hospitals, 1 Military hospital which provides for the public, and 1 Police hospital. Each sector is to be provided with one health centre. However there are currently only 29 Health Centers in

Kigali. There are also a number of private polyclinics which provide health facilities. The quality of service in the health sector in Rwanda has been gradually improving over the years. As more than 90% of Rwandans enjoy medical insurance, access to health facilities is affordable to most people. With the growing population and increasing access to medical insurance, Kigali City will face more demand for health facilities and bed requirements in the coming years. There is currently a shortfall of health centres and district hospitals in Kigali. More such centres and institutes need to be provided to provide better health coverage to the population.

2.9.3 Civic Facilities

INSTITUTIONAL ARRANGEMENTS

Kigali being the capital city has a much larger civic and administrative role. There is a distinct administrative zone at Kimihurura at Gasabo. There are also requirements for national level institutes like the Parliament, Supreme Court, and various Ministries etc. Similarly, there are a large number of central & regional government institutes also located at Kigali. Besides the central government facilities, there are civic facilities necessary for the municipal, as well as district and sector level e.g municipal offices, district offices, sector offices etc. All these are to be provided for in the physical plan. As per NDDP, one civic facility area of approximately 1 ha would be provided per 120.000 inhabitants. However due to Gasabo's role as the administrative hub of the nation, it will have to secure land for the provision of more variety of public facilities.







Library

Playground



Sports Stadium



Cemetery

Fig.2.31 Public Facilities in Kigali



Youth Centre



Referral Hospital

2.9.4 Other Social Facilities (sports & recreational, cultural, religious etc)

The city of Kigali currently has a variety of key social infrastructures facilities like public library, sports fields, stadiums, parks & public plazas for cultural events. There are also a variety of religious buildings like churches & mosques. All these are vital for a vibrant and active society and need to be provided in the new urban setting. As per the previous Nyarugenge master plan prepared by Surbana, these facilities have to be distributed according to the catchment radius, within the township model.

Cemeteries are another such key public facilities required in Kigali. Currently, the government provides land for cemeteries which are given in the form of 20 year lease. Two such new cemeteries were provided at Mageragere in Nyarugenge and Rusororo in Gasabo. Such facilities are necessary for all three districts. However, with the impending shortage of land in the future, new types of cemeteries need to be developed.

Similarly, for large scale social infrastructure



2.9.5 Future Provisions of Facilities

The proposed new townships will cater to the provisions of social infrastructure at a local level such as various levels of schools, civic facilities and hospitals as supporting amenities to the residential use, according to the planning provision standards developed for Kigali City in the Concept Plan. The social amenities proposed for Kigali are derived from comparing the standard proposed in National Land Use Development Plan, standards set by various related ministries and the KCMP and the Nyarugenge masterplan. It is also benchmarked with the South Africa & Singapore public facility provision standards. Singapore standards are taken as comparison considering that Singapore is a well developed high density city state with similar size and projected future population.

The generally slow pace of development



Primary School



Secondary School

of institutional facilities today has reflected clear financial constraints on the government. Therefore more engagements with the private sector through a privatepublic partnership model will have to be extensively pursued in many sectors of social infrastructure development so as to overcome such deficit. A lot of policy incentives will have to be considered so that the profit-driven private sector would be more prepared to undertake such efforts.

For existing development areas in the City, there have already been a substantial number of basic social facilities (schools & health centres) available, despite falling short of the ideal provision level. The improvement will on one hand address the current gap, as well as focus on improving the quality and types of such infrastructure.

Given the persistent provision gap and the largely private ownership of the land within the City areas, it appears illogical for the government to undertake a massive land acquisition just to make land available for social infrastructure, while putting aside the financial limitations. Nevertheless, the many unplanned areas, regardless of the land under private or public ownership, will give hope for future redevelopments. When it takes place, additional social infrastructure such as clinics, health centres, and community centres can then be integrated into these redevelopment sites as part of the overall development plan. However key regional facilities will have to be strategically provided to ensure a healthy community.

2.10 Tourism Development

2.10.1 TOURISM IN RWANDA:

Rwanda, "the land of a thousand hills", is endowed with immense natural beauty wildlife and a temperate climate. Iconic tourism attractions like volcanoes and gorillas have helped establish a unique tourism identity for the country. Besides these, Rwanda is also gifted with lush green scenic hills, tropical forests, mountains, lakes, and a range of fauna. Tourism in Rwanda has been identified as a priority sector to achieve the country's development goals as set out in the Vision 2020 strategy. Significant progress has been achieved in developing and managing its tourism sector in recent years. The tourism revenue itself has grown from US\$26m in 2005 to US\$210m in 2008. 1

INSTITUTIONAL ARRANGEMENT:

MINICOM (Ministry of Commerce, Industry, Investment Promotion, Tourism and Cooperatives) is the body responsible for tourism related policy. Similarly, ORTPN (Office of Tourism and National Parks), which is one of the constituent bodies of the RDB (Rwanda Development Board), and RDB is one of the key institutions responsible for promotion and development of sustainable tourism and wildlife conservation. At a local level, District Councils are responsible for planning community projects and provision and maintenance of tourist services, sites and attractions, and monitoring of standards. An active partner in tourism development is the private sector, which is represented by the Tourism Chamber formed by hotels, tour operators, transport and taxis and private education institutions.

2.10.2 SUSTAINABLE TOURISM DEVELOPMENT MASTERPLAN

Vision 2020 has identified tourism as a priority sector to achieve the country's development goals. To accomplish this, the Sustainable Tourism Master plan was prepared in 2008-2009. Its key objective was to provide stakeholders and potential investors in the tourism sector with a guide to developing a world-class tourism destination attracting a steady flow of tourists. This would enable the development of a tourism industry able to provide quality services and facilities to visitors, employment for Rwandans as well as opportunities and revenue for local communities, while contributing directly to poverty reduction. Three-year action plans were formulated while priority areas were identified. Concept plans were then prepared for these priority areas. Particular emphasis was placed on devising mechanisms to enable local communities to participate in the tourism sector. The Master Plan aims to prepare Rwanda to become a major tourism destination in East Africa.

The Tourism Vision 2020 formulates that, "through well-managed marketing, development and public/private partnerships, Rwanda will become established as a leading wildlife and eco-tourism destination and a regional conference hub, with a high quality, affordable and diversified tourism product that makes a growing contribution to the overall socio-economic development of the country".

The growth target for 2008-2020 for the industry were thus:

- Increase Foreign Exchange Earnings from US\$210m to US\$627m;
- Increase International Tourist Arrivals from 980.000 to 2.219.000
- Increase GDP share by sector (Tourism) from 3.7% to 6.5%

TOURISM DEVELOPMENT CONCEPT:

The tourism master plan has identified key natural resources with tourism potential in the country, which will provide differentiated products creating a unique character for Rwanda. The development concept focuses building on the strengths of these assets by clustering development around them. The master plan has also identified key regions in the country as per their tourism potential as Destination Management Areas (DMAs).

The concept focuses on:

- The creation of a 'hub and spoke' with Kigali City as the main hub, and six other DMAs with 'flagship' visitor attractions.
- The creation of tourism corridors (spokes) and trails that provide linkages between Kigali and the destination areas.

The key identified corridors are:

- Heritage Corridor linking Kigali Hub to Nyungwe DMA.
- Eco-Agro Corridor linking Kigali Hub to Volcanoes DMA.
- Scenic Corridor linking Kigali Hub to Kibuve DMA.
- Community Corridor linking Nyugwe DMA to Gisinyi DMA.
- Ecological Corridor is proposed in the west to link the National Parks.



Fig.2.32 Kigali is the main Hub with 6 other destination management areas



Fig.2.33 Tourism attraction of Rwanda Source: www.dailystar.net, www.albertinebirding.com



¹ Sustainable Tourism Development Masterplan



2.10.3 Heritage & Culture of Kigali

HERITAGE: KIGALI'S UNIQUE IDENTITY

Kigali, besides being the capital city, is centrally located in the country, and remains the main international gateway into Rwanda. The city has thus been designated as the main tourism hub of Rwanda. The city has a variety of natural as well as cultural heritage sites. Besides tangible heritage, it is important for the intangible cultural heritage of the society to also be recognized and conserved. The variety of heritage of the city will help to enhance and develop a unique identity for Kigali.

Kigali itself is blessed with natural assets like the many hills and wetlands, which have immense environmental importance as well as harboring tourism potential. Similarly, the city borders Lake Muhazi to the North and the Nyabugogo river to the south, which are important natural assets and provide immense tourism potential. Besides the natural assets there are several heritage areas in Kigali city, which mark



Fig.2.35 Heritage of Kigali Source: www.kariburwanda.com, www.genocidearchiverwanda.org.rw

Fig.2.34 Heritage and Cultural Features Map

the colonial heritage of the nation. There are also markets in the city's historic area, which should be conserved with proper urban design and economic strategies. There are several unique communities living in Kigali, like the Ukunundu Potter's village in Gasabo, which should be conserved as part of the cultural heritage of the city. There are several genocide memorial sites located at various areas in the city. Special strategy to conserve these important cultural and historic sites needs to be formulated. As Kigali is the capital city, there are several monuments and buildings of national importance which also need to be conserved. Besides theses local and city level precincts or areas, monuments, landmarks and open spaces, which have strong cultural link and local significance, will need to be conserved.



2.10.4 HERITAGE & CULTURAL DEVELOPMENT IN KIGALI:

Kigali with it variety of heritage assets has the potential to capitalize on its unique identity to develop variety of distinct destinations. Each district in Kigali has its own distinct geographic features and unique cultural heritage areas.

Kigali has potential for more communitybased tourism. The villages, like the Ukunundu Potter's Village in Gasabo, needs to conserved and developed as cultural precincts in the city. There is also a need to develop more handicraft bazaars and centres to support local arts and handicrafts to promote local culture.

Rwanda Development Board has identified nine potential tourism sites around Kigali that need to be developed. There is opportunity to integrate these heritage & tourism sites and capitalize further on the tourism potential (Refer Fig.2.36). There is also a proposal to develop a master plan for Lake Muhazi, which is located to the north of the city. The attractions need to be optimized to create a distinct waterfront and adventure based tourism destination.

Kigali remains the business center of Rwanda and attracts variety of business related visitors. The new Conference Centre will help to establish Kigali as a MICE hub and attract new businesses and conferences in the region. Similarly, the previous sub area plans have also proposed several heritage promotion projects, like the Rebero Sub-Area plan which focuses on developing the Rebero area in Kicuriro as a resort and conference centre and a key tourism destination. The Rwanda Development Board also proposes to develop a cultural village in Rebero with a botanical garden, auditorium, traditional huts, eco lodges, campsite, exhibition hall, museum & art galleries.

The concept plan shall integrate these key catalytic projects which will not only help to develop the tourism potential of the city but also conserve the rich culture and heritage of Kigali. The concept plan will focus on developing facilities for international & local tourism by providing recreational and tourism features in various area of Kigali, as well as identify and conserve local heritage assets and integrate them into future planning. All these features will enhance its character and unlock the potential of the area whilst developing the local economy and conserving the heritage.

2.10.5 MANAGEMENT OF HERITAGE ASSETS:

Kigali should develop a heritage strategy to manage its wide variety of assets. This heritage strategy should be an integral part of the urban development framework. As the city gears towards rapid urbanization, it should take stock, identify the heritage assets, and develop policies and incentives to promote heritage conservation and management. There is a need to develop a system to classify and grade heritage assets and develop appropriate heritage regulations, policies and incentives to manage them. A dedicated urban design & heritage conservation division should be part of the city's planning department This division will play the pivotal role in managing the cities heritage assets and deal with the related urban developments.



Fig.2.36 RDB Proposed Tourism Projects Map Source: RDB Tourism Site Development Projects

LEGEND

RUGENDE RADE CENTRE

Ikigatiro Cyarwabugiri
Nyakarima
Ibigabiro Bya Rwabugir
Ibigaro Bya Rwabugiri
Izonga Za Rubigo
Gisozi Memorial Centre
Richard Kand T Palace
Kicukiro Memorial
Kigali Cultural Village
Wetlands
Sector Boundary



2.11 Transportation and Linkages

2.11.1 INSTITUTIONAL SETUP

The roles and responsibility of the main bodies and agencies that are related to the provision of transport or transport related services in Rwanda are as follows:

MINISTRY OF INFRASTRUCTURE (MININFRA)

MININFRA has the overall responsibility to orient and supervise the functioning and management of public institutions and agencies such as the Road Maintenance Fund (RMF), Office National des Transports en Commune (ONATRACOM), Rwandan Civil Aviation Authority (RCAA), Rwanda Transport Development Agency and other agencies to be formed under its subsectors.

The Ministry also has the responsibility to set the rules, regulations and standards for transport related infrastructure.

The priorities for transportation set by the Ministry are as follows:

- Reduce and control transport costs
- Assure the quality and durability of the rural, urban and international transport network
- Improve safety for goods and passengers on the principle modes of transport
- Increase mobility of the population in order to improve access to essential services, education, and employment
- Establish a system to ensure sustainable financing of road maintenance
- Facilitate access to cost effective transport services

Fig.2.37 Transportation Agencies under MININFRA

RWANDA TRANSPORT DEVELOPMENT AGENCY (RTDA)

The agency is responsible for the implementation of government transport policy and planning for the roads, land transport, regional rails, water transport and air transport along with MININFRA.

The roles of RTDA in various transport infrastructures after the planning stage are as follows:

ROAD:

RTDA draws up regulations to ensure safety on the public roads. In additional, RTDA implements, manages, controls and maintains national roads.

RAIL:

RTDA implements regional rail.

WATERWAY:

RTDA implements waterway transport infrastructure and continues to manage and control waterways transport infrastructure. However, the water transport service is to be provided by private operators.

AVIATION:

RTDA implements aviation infrastructure, controls and maintains airport infrastructure to promote safety.

In addition, RTDA provides technical support to local administrative entities on infrastructure development and monitors their activities.

RWANDA CIVIL AVIATION AUTHORITY (RCAA)

The RCCA monitors all civil aviation matters within Rwandan airspace. It does so to ensure that all activities are carried out

in accordance with civil aviation laws and regulations. Much of the legal framework for this regulation was drawn up in Rwanda Civil Aviation Regulations 2008. All civil aviation within Rwanda must comply with the International Civil Aviation Authority.

RCAA is part of the East African Community (EAC) Civil Aviation Safety and Security Oversight Agency (CASSOA) after the integration of Rwanda in the EAC in 2007.

The operation of all airports in Rwanda is carried out by the RCAA, including Kigali International Airport (KIA). The current improvements being undertaken at KIA is under the purview of the RCAA.

CITY OF KIGALI (COK)

The City of Kigali is responsible for planning, constructing and maintaining transport infrastructure within the City.

The following tasks are under the purview of CoK:

ROADS / TRAFFIC JUNCTION:

CoK plans, constructs and maintains all roads within the City. Junction improvements are part of the responsibility of CoK. Traffic Police assists CoK in identifying junctions to be signalized. Specific studies will be conducted to assess the need for signalization of the junction at roundabout. Currently, CoK installs, manages and maintains all the traffic lights within the City.

CoK also coordinates the development and maintenance of main city roads with the districts

STREET FURNITURE & LIGHTING:

CoK will also coordinate with various authorities or departments to provide and maintain the street furniture and lighting e.g. Energy, Water and Sanitation Authority (EWSA) for street lighting.

PUBLIC TRANSPORT:

CoK constructs, rehabilitates and maintains taxi parks and bus shelters within the City.

ROAD MAINTENANCE FUND (RMF)

This institution is responsible for governing the funding road maintenance and specific road construction projects. The RMF was established in 2006. The mandate for the RMF is to maintain the classified road network across the whole of Rwanda. This includes National Roads, District Roads, City Roads and other urban roads.

The financial resources for the RMF are raised through the following means:

- State Budget.
- Road user tax on gas, oil and petrol.
- Road toll levied on foreign vehicles.

This organisation is also referred to as Fonds d'Entretien Routier (FER).







Fig.2.39 Transport- related departments under RURA

Fig.2.40 Rwanda National Police Setup

LOCAL DISTRICT OFFICES

The local district offices are responsible for public transport initiatives within each specific area of jurisdiction. This includes projects such as construction of bus stations.

The district offices are responsible for the maintenance and development of minor unclassified roads outside of the remit of the RMF.

RWANDA UTILITIES REGULATORY AGENCY (RURA)

RURA has a wide ranging responsibility covering regulation of utility companies as well as aspects of transportation.

RURA has the following mandate in relation to transport: 'to assess road transport performance, establish a strategy for improving regulation, and ensure a competitive and vibrant transport sector for goods and people.'

Specifically, RURA licences road transport operators, air transport operators and driving schools.

RURA also licences petrol stations and produces guidance for the design of related facilities. This guidance includes stipulations for permitted siting and locations of the stations.

Environmental issues caused by road transport such as air quality and noise are also the responsibility of RURA. Of particular concern is that caused by freight and public transport. (refer to Fig.2.39)

ONTRACOM

This organisation was formed to encourage the use of public transport and to ensure availability of public transport to all Rwandese including the population living in rural areas.

This task has been carried out through the provision of government subsidised buses to ply rural routes that commercial bus companies do not find attractive.

RWANDA FEDERATION OF TRANSPORT COOPERATIVES

The formation of the federation is mainly aimed at boosting the financial ability of the taxi drivers' fraternity. This federation is made up of operators providing all forms of public road transport.

This organization was formed after ATRACO was dissolved and merged with other transportation groups.

This body is monitored by the Government through the Rwanda Cooperative Agency (RCA) which is a Public Institution in charge of Promotion, Registration and Regulation of Cooperatives in the Country.

RWANDA NATIONAL POLICE (RNP)

The traffic police unit of Rwanda National Police is responsible for safety of roads and security of airport and water transport. (refer to Fig.2.39)

Hence, the traffic police unit takes on the following tasks:

- Set-up and implement laws relating to road traffic and safety
- Establish guidelines for road signs, road markings and driving license examination
- Issuing of drivers' licenses
- Inspect motor vehicles

RWANDA DEVELOPMENT BOARD (RDB)

Whilst the RDB does not have a direct mandate for road construction within Rwanda, certain roads are constructed through this organisation. An example of this is the development of the Free Trade Zone, where road infrastructure has been constructed by RDB and will be handed over to RDTA. EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

2.11.2 AIR TRANSPORTATION

EXISTING CONDITION

Kigali International Airport (KIA) is one of the two international airports in Rwanda. It is the principal passenger airport and the main entry point for international passenger services. It is managed and operated by the Rwanda Civil Aviation Authority (RCAA).

The current location of the airport is 11km east of the central business district (CBD). The principle transport links to the airport are by road. The Route National 3 passes by and forms the main means of access to the airport from the CBD.

The airport and the immediate area surrounding it lies on a flat land at the top of the ridge. The airport runway itself is approximately 3500m x 45m. This limits the size of aircraft that can safely utilise the airport. This topography precludes the possibility of further expansion of the airport as the current layout utilizes all the available level ground. Fig.2.42 shows the surrounding topography and illustrates the constraints facing any expansion to the current airport.

The surrounding land use is a mix of commercial and residential. The close

proximity of developments around the airport poses serious safety concerns incase of any unfortunate accidents.

The peak hourly passenger figures at Kigali International Airport (KIA) are as follows: **INTERNATIONAL PEAK HOURLY PASSENGERS** -Arrivals: 819 Departures: 495

DOMESTIC PEAK HOURLY PASSENGERS -Arrivals: 23 Departures: 17

Statistics released by RCAA show that in 2010, over 300,000 passengers used the airport. The demand is predicted to increase over the next decade with more than 1 million passengers per annum expected by 2025. Based on observed past increase in cargo and passengers numbers, and projected increase in Rwanda's GDP, it is anticipated that the current airport will be inadequate to meet future air transport requirements.

Given the economic importance of the airport, there are plans to supplement the capacity of the KIA. As the surrounding topography of KIA makes further expansion unlikely, a new site for an additional airport has been selected at Bugesera District, an area south to Kigali City.







Fig.2.42 Map with location of Kigali International Airport



2.11.3 PLANNING INITIATIVES FOR NEW AIRPORT

BUGESERA AIRPORT MASTER PLAN

The new international airport is planned to be constructed at Bugesera, which is about 40km south-east of Kigali on the Bugesera road.

The current plan is that upon completion, Bugesera Airport will complement Kigali International Airport. The airport is initially expected to handle over 1 million passengers annually during its first phase. It will have the capacity to handle 15,500 tonnes of cargo annually.

The first phase of the Bugesera Airport construction is projected to be completed in 2016 and will reach capacity in 2025. It will have one 4,220 m x 60 m runway with an entering and existing taxiway serving up to 18 aircraft movements per hour. This will provide for a capacity of 1.3 million passengers per year. It has been identified that there is a need to strengthen the transport links between the airport and the Kigali CBD in order for the airport to operate effectively.

Intermediate phases of development of the airport will increase the capacity to serve up to 42 aircraft movements per hour and up to 12 million passengers per annum. This capacity development will be delivered through additional taxi ways and expanded passenger facilities.

In the longer term, the capacity is expected to be increased to 82 movements per hour and up to 60 million passengers per annum. This will require expansion of the passenger terminal and the construction of an additional parallel runway.

Fig.2.43 Proposed Bugesera International Airport

DEVELOPMENT OF AN INTEGRATED PUBLIC TRANSPORT SYSTEM FOR CITY OF KIGALI

A requirement for a regular bus service linking the CBD to the current airport has been identified in this planning initiative. The planned bus route links the major taxi parks and CBD to the airport with a scheduled regular service. This bus route is identified as being one of high importance and is therefore placed as a short term measure.

KEY ISSUES RELATED TO AIRPORT

- TRANSPORTATION LINKS TO PROPOSED AIRPORT: The new airport is located 40km aways from the Kigali CBD. The journey time to and from the airport is critical to ensure viability. Unpredictable journey times or excessively long journeys will make the operation of the airport less effective.
- **REHABILITATION OF THE EXISTING KIA:** The current airport location represents potential safety issues for the surrounding residents. Flight operations are better located away from densely populated areas.
- LINK BETWEEN THE AIRPORT AND THE RAIL: The current master plan for the Bugersera Airport utilises the planned railway. This complements and supports the cargo and freight requirements. However, the current alignment of the rail as per the rail feasibility study implies that there is a considerable distance between the planned rail station and the airport.
- CONGESTION AROUND EXISTING KIA: The road network leading to KIA experiences chronic congestion during peak period. With the planned increase in air travel demand, this situation will only be exacerbated.

2.11.4 ROAD NETWORK

EXISTING CONDITION

City of Kigali is well connected to other parts of Rwanda and beyond by a network of National Roads. The CBD forms the centre of a radial network of mostly paved roads, which connect Kigali to its surrounding countries, e.g. the Democratic Republic of Congo (DRC), Burundi, Tanzania, and Uganda. Even though the roads are paved, they are not all well maintained. Of these National Roads, the routes to Gitarama, Rwamagana, and Byumba are the most widely utilized.

The major National Roads within the City of Kigali to other regions in Rwanda and beyond are listed below:

1. Kigali – Gitarama – Butare – Akanyaru – Burundi (190 Km)

- 2. Kigali Kibungo Rusumo Tanzania (167 Km)
- 3. Kigali Kayonza Kagitumba Ouganda (191 Km)
- 4. Kigali Byumba Gatuna Ouganda (80 Km)
- 5. Kigali Ruhengeri Gisenyi DRC/Goma (156 Km)
- 6. Kigali Butare Cyangugu Ruhwa Bukavu (284 Km)
- 7. Kigali Butare Cyangugu Rugarama– Burundi (322 Km)

Within Kigali, apart the above mentioned routes, the road network is not extensive. Outside of the main urban area, many of the major roads follow the topography and are located primarily on the ridges or in the valleys. The existing local road network has not been implemented to any consistent hierarchy and construction method.

ROAD TYPE

The existing roads within Kigali are either paved or earth roads. Roads within the Gasabo and Kicukiro District are mostly unpaved and of single carriageway without uniform side table and road furniture. These unpaved roads, as shown in Fig.2.44, become water-logged during the wet season and dusty during the dry season. They are also vulnerable to water damage from surface runoff.

The paved and unpaved roads in Kigali are shown in Fig.2.45. The surfacing materials for the paved roads can be either tarmac or cobblestone as illustrated in Fig.2.47.New paved roads have also been constructed in tandem large developments e.g the FTZ in Gasabo District.

The topography of Kigali is undulating and made up of a series of ridges and valleys. This has been one of the factors constraining the development of an efficient road network in the city. Fragmented developments has also prevents formation of any consistent grid network or street hierarchy in the city.

The total length of roads in Kigali is 732 km of which only 13.2% are paved. Table 2.11 shows the lengths of different types of roads.

Table 2.11 Length of Types of Roads

Types of Roads	LENGTH (KM)	%
Paved	96.60	13.20
COBBLED	5.90	1.00
Earth Roads	629.50	85.80
TOTAL	732.00	100.00

Source: City of Kigali, Infrastructures Department



ASABO DISTRIC

Fig.2.44 Paved and Unpaved Roads Map





Fig.2.45 Paved Road in new residential area in Gasabo District



Fig.2.46 Unregulated On-street Parking



Fig.2.47 Cobblestone road in Kicukiro District



Fig.2.49 Unpaved Road



Fig.2.48 Absence of traffic marking on the road and junction



Fig.2.50 Inconsistent road elements

EXISTING ROAD CLASSIFICATION

Rwandan government has recently published the Official Gazette No. 04 of 23/01/2012 establishing the law governing the roads in Rwanda. The Official Gazette states that public road networks shall comprise the following classifications:

NATIONAL ROADS:

- National roads comprise the following categories:
- 1.International roads that link Rwanda with neighbouring countries;
- 2.Roads that link Districts or that link a District and the City of Kigali;
- 3.Roads that link areas of tourist significance and facilities of National or international importance such as ports and airports.

DISTRICTS AND CITY OF KIGALI ROADS AND THAT OF OTHER URBAN AREAS – CLASS 1 :

Class 1 Roads are roads linking different Sector's headquarters within the same District, or those roads that are used within the same Sector.

DISTRICTS AND CITY OF KIGALI ROADS AND THAT OF OTHER URBAN AREAS – CLASS 2:

Class 2 Roads are arterial roads that connect Districts roads to rural community centres that are inhabited as an agglomeration.

SPECIFIC ROADS:

Specific roads are specifically constructed to connect National roads or District roads to Kigali City and other urban areas to the centres for private sector's activities such agricultural production, natural resources processing or to tourist sites.

The Gazette also stipulates road dimensions such as the minimum lane width, minimum carriageway width and road reserve. The road reserve includes embankments, edge areas, bollards, road lighting facilities, water drainage facilities, grassy strips, central median strips, hard and soft shoulders, fills, walls, stairs, bridges, tunnels, technological and artistic works, road signs and other elements related to road. Existing roads do not have consistent road elements like standard curb and verge dimensions.

Table 2.12 Classification of Roads

CLASSIFI- CATION	Mini- mum Lane Width	MINIMUM Carriage- way Width	Road serve	Re-
NATIONAL ROADS	3.5M	6.0M	22M	
CLASS1	3.5M	-	22M	
CLASS 2	-	6.0м	12M	

GEOMETRIC DESIGN

The existing road network is largely guided by the existing terrain. Some of the existing local earth roads are very steep and would not meet international standards for acceptable road gradients.

There are currently no formal Rwandan guidelines to standardise the geometric design of the roads. MININFRA has an intention to adopt American Association of State Highway and Transportation Officials (AASHTO) standards as an interim measure before Rwandan geometric design guidelines are formalised.

Based on the Official Gazette No. 04 of 23/01/2012, it is stated that "A Ministerial shall define the technical and service standards for roads based on the study and research conducted by experts on the

entire road network of Rwanda in general." Hence, it is the jurisdiction of the MININFRA to develop technical and service standards for roads.

ON-STREET PARKING

Parking in rural areas is generally haphazard as no proper parking space is available. The parking situation is comparatively more controlled in the urban areas like in the CBD. On-street curb side parking, as shown in Fig.2.46, is the most common form of parking with few developments providing adequate parking within their land parcels. Hence, parking is not systematically enforced throughout Kigali. The city currently working to establish multistorey car parks in key areas. The Nyarugenge masterplan provides car parking requirements and standards for all new developments.

TRAFFIC MANAGEMENT SYSTEM

The majority of road junctions are unsignalised. Traffic management systems such as traffic signals and roundabouts are found in the urban areas, mainly in Nyarugenge District. Currently, there are a total of 16 traffic light junctions. These traffic signs operate on a fixed time plan only and do not have any traffic sensors to respond to changing demand. Multiple manufactures of traffic light are used in the City and the City of Kigali intends to replace all the old traffic lights with new ones. This will assist the standardisation of the traffic light so that a centralised traffic lightsn coordinating system could be implemented in the future to optimize the performance of the junctions.

The current traffic signals are not optimised

to traffic demand prior to installation, and traffic signals do not have any priority signs in case of malfunctioning. The City also lacks any specialists to optimise the signal timings for the traffic lights. Training will be required to further enhance the skills of personnel managing the traffic lights. Normal traffic light operation is frequently interrupted by power outages. This represents a significant road safety issue.

Traffic calming methods such as multiple speed-reducing humps are found on certain roads to reduce the speeds of vehicles especially in areas where there are tight corners and steep gradients. However, these are improperly designed and in many cases, not fully maintained.

Traffic markings are not commonly found on the road. It is likely that the markings are not fully maintained. There are no guidelines to standardise traffic markings in Rwanda. This lack of standards leads to different marking schemes being observed across the city.

FREIGHT TRAFFIC

A major border post is located in Gikondo, which regulates the goods going into and through Kigali City. Freight traffic plies through the existing road network to reach the border post.

Lorries have to park along the streets around the border post to complete their customs clearance as there is insufficient parking space within the designated parking area which is within the enclosed area of the border post. Heavy trucks are prohibited in the CBD during day time unless permission is given by traffic police. However, the trucks are allowed to use the roads at night.

ROAD SAFETY

The urbanised areas of Kigali City experience higher accidents numbers, approximately 79% of accidents occur in the City. This can be due to a higher number of motorised vehicles on the road in the City as compared to the rural areas.

Table 2.13 Number of Accidents in City of Kigali and its Districts

LOCATION	NUMBER OF ACCIDENTS IN 2010		
NYARUGENGE	1738		
GASABO	1619		
KICUKIRO	494		
CITY OF KIGALI	3851		

Source: Rwanda Transport Master Plan, 2012

2.11.5 PLANNING INITIATIVES FOR LAND TRANSPORT

STRATEGIC TRANSPORT MASTER PLAN FOR RWANDA

Ministry of Infrastructure (MININFRA) has initiated a strategic transport master plan for Rwanda with the distinct purpose of formulating the detailed transport strategies for the medium and long-term planning horizon (10- years).

The reports on the following specialised issues were produced while developing the strategic master plan.

- Status of the Transport Sector in Rwanda
- Cross-Cutting Issues Impacting on the Transport Sector in Rwanda
- Calibration, Validation and Application of the Transport Model
- Recommendations to improve inter-city and rural public transport services
- Institutional Structure for the Transport



Fig.2.51 Location of Dry Port in Kigali



Fig.2.52 Kigali Street Addressing Boundary Map

Sector In Rwanda

- Appraisal of Transport Infrastructure and Transport Services Projects.
- Appropriate Options for Public Private Partnerships
- Programming of the Master Plan

KIGALI STREET ADDRESSING

Kigali City's Addressing Project allows the City, municipalities and districts to identify plots, facilities, delivery of goods and services using a coherent street addressing system. A GIS database, containing all the names of street, has been produced.

ROAD IMPROVEMENT

There are many road improvement projects currently underway in Kigali. The following are the major projects being carried out.

- The Feasibility of Widening of the Kigali-Ruhengeri Road
- Rehabilitation of 83.1km Kigali Ruhengeri Road
- Rehabilitation of Kigali Kayonza
- Development of Kigali Gatuna
- Development of 21 km Kicukiro Kirundo (Kibugabuga – Ruhuha)
- Development of 21 km feeder roads between Bulinga – Remera
- Gitarama Ngororero Mukamira Road Project

KEY ISSUES RELATED TO LAND TRANSPORT

ROAD CONDITION:

Many of the unclassified roads are unpaved and criss-crossing hilly terrains with very steep gradient at various locations within the District. They are mostly of narrow single carriageway without proper road furniture and drainage provision. A large part of the secondary road network, both paved and unpaved, require rehabilitation and routine maintenance.

DEVELOPING STANDARDS FOR GEOMETRIC DESIGN AND TRAFFIC MARKINGS:

Currently, Rwanda adopts right-hand driving convention, similar to countries to the west of Rwanda. However countries to the east of Rwanda drive on the left. Rwanda is also part of the East African Community, which has the intention to harmonize design standards for roads.

Since Rwanda and the East African Community do not adopt the same driving convention, any proposed road standards should be compatible with Rwanda's driving convention when harmonizing with the standards in East African Community.

PLATFORM LEVEL OF DEVELOPMENTS IS SIGNIFICANTLY HIGHER OR LOWER THAN ROAD LEVEL:

It appeared that the existing road level is not taken into consideration when planning for the platform levels of some of the developments in the City. The following disadvantages can occur when there is a significant difference between platform and road level.

- Steep gradient from the road to the development
- Safe sight distance at the access point can be compromised
- Vehicles need to move slowly from the main road to the development if the gradient is steep. Therefore, it can reduce the capacity of the main road

2.11.6 RAIL NETWORK

EXISTING CONDITION

There is currently no railway in either Kigali or in Rwanda. The mountainous nature of the terrain in Rwanda makes the implementation of rail very challenging and potentially expensive. The gradient of a railway directly affects the load capacity and speed of trains.

A railway in Rwanda has been identified as a means to stimulate trade of goods with partner countries of the East African Community. The lack of any existing rail in Rwanda has lead to various planning projects proposing different schemes and options.

As there are currently multiple options for the final rail alignment and the extent of the railway, a brief summary of the rail initiatives being proposed is presented in the following sections.

PLANNING INITIATIVES FOR RAIL

EAST AFRICAN RAIL MASTER PLAN:

As a member of The East African Community, Rwanda is part of the plans to connect the region via rail. The East African Railway Master Plan is a proposal for rejuvenating the existing railways serving Tanzania, Kenya, Uganda and extending them into Rwanda and Burundi and ultimately to South Sudan, Ethiopia and beyond. The cooperation and integration of the railways from the surrounding countries is essential to make the rail proposal viable.

One of the principal recommendations within the plan is to harmonise the different gauges in operation across the region.

The following is a list of the different gauges in operation in the surrounding countries:

Uganda - 1,000 mm (3 ft 3 3/8 in) Tanzania - 1,000 mm (3 ft 3 3/8 in) and 1,067 mm (3 ft 6 in) Burundi – No Rail Congo - 1,067 mm (3 ft 6 in) Kenya - 1,000 mm (3 ft 3 3/8 in) Zambia - 1,067 mm (3 ft 6 in)

RWANDA NATIONAL LAND USE MASTER PLAN (RNLUMP)

This plan sets out extensive provision of rail for the entire country. The proposed rail alignment has connections to Tanzania, Uganda and Lake Kivu.

The alignment being proposed is based on the Feasibility Study project. However, it extends the rail alignment further north beyond Kigali. The alignment shown passes directly through the City of Kigali.

Although an alignment is shown, this is clearly in the conceptual stages and will require detailed studies.

STRATEGIC TRANSPORT MASTER PLAN FOR Rwanda

This is a comprehensive transport master plan for the entire country and includes the same extended rail alignment as seen in RNLUMP.

There are several transport scenarios explored in the report, one of which is a rail scenario giving the rail alignment as 615km with a 14% mode split utilising the rail.

The section of rail to the north of Kigali is described as conceptual and subject to the successful implementation of the southern section of rail.

The northern section of rail links Kigali to Gisyeni.

The report suggests that rail should be used for passenger commuting if the extension across the country is realised.

DEVELOPMENT OF AN INTEGRATED PUBLIC TRANSPORT SYSTEM FOR CITY OF KIGALI

This project is currently in progress. An interim study report has been produced that describes the short and medium term policies and infrastructure implementation plans required for the City of Kigali.

Within this document, no mention is made of exploiting rail for passenger services. There is also no mention of para-transit services to support rail.

The conclusion is that this study was prepared without the expectation of rail playing a role in providing commuter capacity for the City of Kigali.

MULTINATIONAL TANZANIA - RWANDA - BURUNDI, FEASIBILITY STUDY FOR THE ISAKA - KIGALI/KEZA -MUSONGATI RAILWAY PROJECT

This is the first detailed plan for the railway with the intention to link Rwanda, Burundi to the Tanzanian railway at Isaka Station and provide sustainable rail transport linkage to the Port of Dar-es-Salaam. The study was funded under a grant extended by the African Development Bank (AfDB), complemented by a financial contribution of the Development Bank of Southern Africa (DBSA).

This plan has been carried out in cooperation with the Governments of Tanzania and Burundi. This is a comprehensive plan that goes as far as proposing stations at Kigali,



Fig.2.54 Proposed Rwanda Rail Network Source: RNLUMP



Fig.2.55 Alignment of rail through Kigali Source: Multinational Tanzania - Rwanda - Burundi, Feasibility Study for the Isaka - Kigali/Keza - Musongati Railway Project

Bugesera, Isaka and Gitega.

The details of the proposed railway system in Rwanda are as follows:

- Branch line from Isaka to Kigali splits at Keza
- 494 km Isaka to Kigali
- 186 km Keza to Kigali
- 800 m long trains with a top speed of 120 km/hr
- 3-4 Locomotives per train will be required to attain the carrying capacity and speeds required for the railway.

The capital cost to implement the plan is estimated at US\$3.7 billion. Funding will be through the African Development Bank (AfDB),

The main design parameters for the new lines are: Rail UIC60, track gauge of 1,435 mm (4ft 8½in) standard gauge and axle load of 2 t. This is the gauge of the trains operated by the consulting company in Germany, which carried out the study.

General Cargo and iron ore are expected to be carried on the railway line with the ore requiring dedicated wagons. This will represent the main part of the demand.

Passenger traffic is limited to the regional traffic on the Project Line, i.e. to the triangle between Isaka, Kigali and Musongati. Gashora - Kigali on the Main Line is expected

Table 2.14 Details of proposed rail line

LINE SECTION	TRAINS PER DAY AND DIRECTION			
	2012	2029	2044	
Keza – Kigali	9	12	19	

Source: Multinational Tanzania - Rwanda - Burundi, Feasibility Study for the Isaka - Kigali/Keza - Musongati Railway Project

to carry the highest number of passengers. The base number of trains is one every four hours. For this section of rail, the frequency will be increased to a train every 2 hours.

KEY ISSUES RELATED TO RAIL

EFFECTIVELY UTILISING THE PROPOSED RAIL FOR PASSENGERS:

The terminal for the rail is located a significant distance away from the CBD of Kigali. The effect of this is that the rail will not be convenient for commuting to the CBD.

RESERVING A RAIL CORRIDOR WITHIN THE CITY OF KIGALI:

The plan for the extension of the rail north of Kigali requires the alignment to pass within the City. If this proposal goes ahead, it will be important to ensure that it does not sterilise large tracts of land or allow the rail to form a barrier.

RAIL GRADIENT:

The undulating terrain of Rwanda poses a challenge in laying an efficient rail network, If the grades are too steep, they can significantly limit the capacity of the rail or require more locomotives to be employed.

2.11.7 PUBLIC TRANSPORT SYSTEM

EXISTING CONDITION

Car ownership in Rwanda is one of the lowest in the world with 8 cars per 1000 population. Car ownership in Kigali City is approximately 40 cars per 1000 population. Currently, 80% of motorised trips is by public transport. The majority of the population walks, cycles, or takes public transport as means of transport.

There are 5 types of public transport services provided in Kigali.

- Mini-buses
- Bus
- Taxi
- Motorcycle Taxi
- Bicycle Taxi

MINIBUSES (MATATUS)

Minibuses are the most common form of public transport. As shown in Fig.2.57, most passengers choose 18-seater minibuses for their daily commuting. These minibuses are privately owned by different operators, and their routes and schedules are not centrally coordinated. These minibuses do not have specific operation schedule. The buses do not follow fixed schedule in the terminal as well as the stops. With no fixed timings, approximately minibuses wait to fill up before setting off from the terminus, while picking up and dropping off frequently en route. 35% of the passengers require a second bus to complete their journey.

The fare of the minibuses is determined by Rwanda Utilities Regulatory Agency (RURA) at the rate of 20 Rwf/km. The fare normally ranges between 150 Rwf to 250 Rwf depending to the route travelled, since passengers pay according to the route travelled and not according to distance travelled.

The following are some of the existing licensed minibuses operators:

- Okapi Car
- Virunga Express

The interest of public transport companies is served by Rwanda Federation of Transport Cooperatives

Bus

The bigger buses usually provide longhaul international services from Kigali to Kampala, Nairobi, Kenya, Tanzania and Burundi and also inter-city services to Lake Kivu.

Kigali Bus Services operates the larger 80-seats buses. They are the first bus service provider to implement the automated ticketing system by using contactless smart card. Other bus services still utilize the traditional paper based ticket ing system.

The following are some of the existing licensed bus operators:

- Kigali Bus Service
- Onatracom
- Jaguar Bus Company

Currently there are 5 bus terminals in the City. The berthing, queuing and ticketing systems in the terminals and stops are haphazard.

There is also a lack of pedestrian facilities within the bus terminal. It has been observed that the passenger entry and the bus exit is shared and not segregrated creating potential conflict areas. There are no crossings or linking facilities for the



Fig.2.56 Map showing Location of Bus & Taxi Terminals



Fig.2.57Proportion of bus trips per daySource: Assessing Public Transport Supply for Kigali, Rwanda



Fig.2.58 Minibus at bus stop with bus shelter

passengers to get from one bus waiting area to another. Pedestrian traffic and vehicular traffic circulation should ideally be separated in the bus terminal.

Two of the three bus terminals in Gasabo District are currently funtioncal. The new Kubuga Bus Terminal is being redeveloped and will be able to serve 85 minibuses. There will also be supporting retail service such as kiosks in the future phase, to complement the bus terminal. The rehabilitation of Kubuga Bus Terminal is funded by CoK. Upon completion, the management and maintenance of the bus terminal will be handed over to Gasabo District. The rehabilitation of the bus terminal is a design-and-built project which was awarded through an open tender.

Kigali Bus Services intends to construct another bus park for its buses around the Free Trade Zone in Gasabo District. In Kicukiro District, Nyanza Bus Terminal was constructed in 2009. The bus terminal will be better utilitised with increasing developments in the area and the vicinity. Bus services, operating from within Nyanza Bus Terminal, have to pay tariff to Kicukiro District. Minibuses are observed to park outside Nyanza Bus Terminal and the bus terminal compound is currently serves as a bus park for Kigali Bus Services.

It has been noted in the "Summary Report on Development of an Integrated Public Transport system for City of Kigali" that there is congestion in existing bus terminals during peak hours.

Some of the bus stops are constructed with bus shelters, however most of them lack a bus bay. Large number of minibuses aggravate traffic congestion by stopping at bus stops outside market areas and key destination to pick passengers. These bus stops do not have shelters as well as bus bay. However it has been observed that in the new townships that have been developed in Gasabo, the bus stops are designed with bus bays but do not have shelters to protect the waiting passengers from the elements.

The Summary Report on Development of an Integrated Public Transport System for City of Kigali highlights a lack of central planning or standardization used in design and development of road and supplementary infrastructure which has a detrimental impact on transport vehicles and hinders efficient operating of traffic within the city.

TAXI

There are 3 different types of taxi services operating within Kigali City –Taxi, Motorbike Taxi and Bicycle Taxi. Taxi operators can acquire the liscence to operate after registering with RURA. These taxis service providers are under the umbrella of their own associations and only operate within their own sector.

There is a lack of parking spaces for these taxi services. In February 2012, CoK allocated 53 motorcycle parking areas in major zones of the City to regulate parking of motorcycle taxis. More parking areas are expected to be provided in the future.

TAXI:

There are 370 registered taxis operating in Kigali City. However, there are also a large number of unregistered taxi services operating in Kigali.

MOTORCYCLE TAXI:

Another popular mode of transport, is the

motorcycle taxi which offers a quick and efficient way to travel, especially to rural areas with unpaved roads and steep slopes. There are approximately 7,000 motorcycle taxis operating in Kigali City which are managed by various private operators. However, there is a significant number of motorcycle taxis that operate without license and permits in additional to the above-mentioned number.

Fares of these motorcycle taxis are loosely regulated. The fares typically range from 200-1000 Rwf. Registered motorcycle taxis are only allowed to operate within the registered sector.

BICYCLE TAXI:

Bicycle taxis, are forbidden in the City area, but are popular in the rural areas in Gasabo and Kicukiro District as alternative mode of transport to motorcycle taxi. Similar to motorcycle taxi, registered bicycle taxi operators are allowed to operate only within their registered sector.

PLANNING INITIATIVES FOR PUBLIC TRANSPORT

CONSULTING SERVICES FOR THE PLANNING AND DESIGN OF A PUBLIC TRANSPORT SYSTEM FOR KIGALI CITY

Ministry of Infrastructure initiated a study to plan and design an integrated public transport system for Kigali City. The assignment involves travel demand assessment, multimodal transport analysis, planning and detailed design for a comprehensive public transport system in Kigali City. This project is provides:

- Assessment of Current Traffic Situation and Status of Public Transport System
- Review Data Requirements and Collection
 of Data
- Development of a Hierarchical Multi-Modal Transport Model : Model Development

DEVELOPMENT OF AN INTEGRATED PUBLIC TRANSPORT SYSTEM FOR CITY OF KIGALI

With the deteriorating public transport situation in Kigali the Ministry of Infrastructure has formed a technical committee to prepare a report which identifies the existing transport problems, and public transport services in Kigali City and recommend potential remedial measures in an emergency basis. Below are the recommendations from the summary report.

- Consider land-use when planning for transportation infrastructure and viceverse
- Traffic demand and supply management can be integrated with land-use development
- Implement parking policy to manage parking demand and traffic

congestionReduce the number of bus operators and prioritise bus operators with a large fleet of standard high occupancy vehicles

- Integrate multi-mode, multi-route and multi-operator public transport system through integrated public transport ticketing system and real time information system
- Ensure reliable and convenient bus service with fixed schedule and priority routes on the roadway in at least three major transport corridors of the Kigali City
- Integrate pedestrians with the public transport facilities by providing adequate footpath and at grade priority crossing at suitable locations

KEY ISSUES FOR PUBLIC TRANSPORT

Some of the challenges faced by the City are as follows:

- Mini-buses have high public transport market share, however they are not efficient in terms of carrying capacity and road space utilisation.
- Minibus routes and timetables of the service are irregular. Hence, the travel needs of the public are not well-served.
- Lack of spaces reserved for bus facilities
- During planning stages, public transport facilities are not considered. Hence, there is no land set aside for such facilities.
- Lack of pedestrian facilities in bus terminals
- Current bus terminal layouts do not take into account the pedestrian movements. Safety of the pedestrians can be compromised when vehicles and pedestrians come into conflict.

2.11.8 WALKABILITY AND CYCLE MOBILITY

EXISTING CONDITION

Although walking is the predominant mode of commuting in Rwanda, there is a general lack of amenities that cater specifically to pedestrians and cyclists.

Only the paved boulevards and avenues in the CBD area and the roads in the new residential area of Gasabo District have pedestrian sidewalks. In many cases, these are inadequate, not continuous or not fully maintained. A dedicated pedestrian walkway is generally absent on mud tracks and rural roads. The construction of pedestrian walkway is dependent on funding.

Lack of pedestrian facilities increases the vulnerability of pedestrians to road accident. Pedestrians are the largest group among the traffic accident fatalities. From September 2010 to September 2011, there are 180 cases of pedestrians injured by road accidents in Gasabo District and 118 cases in Kicukiro District.

PLANNING INITIATIVES FOR WALKING AND CYCLING

SHARE THE ROAD:

"Share the Road" is a United Nations Environment Programme (UNEP) initiative to encourage NMT transport in developing regions where majority of people – those moving by foot or bicycle – are disadvantaged on the road.

The overall goal is to promote policies in government and donor agencies that invest in walking and cycling road infrastructure.

UNEP Transport Unit has identified Rwanda as a pilot country to be part of "Share the



Fig.2.59 Bus stop without bus bay



Fig.2.60 Contactless Smart Card Reader



Fig.2.61 Bus Terminal in Kicukiro without pedestrian facilities



Fig.2.62 Motorcycle taxis



Fig.2.63 Bicycle Taxis



Fig.2.64 Bus Stop without bus shelter



Fig.2.65 Accident Fatalities by Vehicle Type, 2010 Source: RTDA



Fig.2.66 Pedestrian walking on the road



Fig.2.67 Absence of pavement along the road

Road" programme. A site in Kigali CBD has been selected to be the pilot study area for walking and cycling infrastructure. Study of this pilot project is ongoing. MININFRA and RTDA are working with UNEP to develop transport policies and standards that incorporate the needs of non-motorised transport. Non-motorised transport (NMT) refers to walking, cycling, and variants such as wheelchair, scooter and handcart use.

DEVELOPMENT OF WALKING AND CYCLING FACILITIES FOR URBAN AND SEMI-URBAN ON CLASSIFIED NATIONAL ROAD NETWORK OF RWANDA:

The study was published in May 2011 by RTDA and suggested two methods of integrating NMT into the roadway:

- Allow NMT to share the carriageway with motorized transport; strict enforcement is required.
- Exclusive paths for pedestrians and cyclist and motorists.

Understanding that the NMT initiative will not be achieved without the establishment of policy and setting out a detailed framework for development of NMT facilities, RTDA is liaising with various decision, policy makers, and stakeholders on the needs of NMT infrastructure and action plan.

STRATEGIC TRANSPORT MASTER PLAN FOR RWANDA:

The Master Plan highlights the need to consider NMT as part of the transport system. They should not only be restricted to rural areas, but also as a form of flexible and affordable mode of transport for the poor in urban areas.

The Master Plan attempts to establish the existing NMT framework in Rwanda, but

concluded that there is no existing strategy in place.

Other concerns which are identified are unavailability of NMT data to understand existing conditions and future demands, and NMT's users needs are not catered for even though Rwanda National Land Use and Development Master Plan recognizes the need to incorporate NMT into the transport planning framework.

The Master Plan also emphasize that the appropriate infrastructure should be provided in tandem with land-use planning to orientate towards NMT focus.

DEVELOPMENT OF AN INTEGRATED PUBLIC TRANSPORT SYSTEM FOR KIGALI CITY:

The study suggests strategies to optimize the public transport to provide full access for pedestrians such as:

- Ensuring uninterrupted pedestrian movements;
- Forcing vehicles to slow down or minimizing free-flowing vehicle turnings;
- Prioritizing safe pedestrian movements at traffic junction;
- Allowing pedestrians to cross in a direct line across traffic junctions and clearly indicate the direction of travel for all pedestrians; and
- Increasing pedestrian visibility.

The study recommends using traffic calming measures or installing pedestrian-activated signals for at-grade crossings instead of grade-separated crossings.

The study also noted that bicycle mode share is currently low in Kigali. Bicycles should be integrated with the Bus/BRT system, initially by ensuring that safe parking is provided at convenient locations.

KEY ISSUES FOR WALKING AND CYCLING

LACK OF PEDESTRIAN FACILITIES ALONG THE ROAD: There is no continuity in pedestrian facilities from one development to other developments or commuter facilities. This will compromise on the safety of the pedestrian.

TOPOGRAPHY OF KIGALI:

For cycling path to be safe for cyclist, AASHTO recommends the road gradient of not more than 5%. In view of the hilly terrain of Kigali, it will be a challenge to implement a comprehensive cycling network.

SAFETY FOR ROAD USERS:

With the promotion of NMT in Rwanda, infrastructure for NMT has to be incorporated into the existing system. The challenge will be to determine a suitable approach to manage NMT and motorized transport in a safe manner. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

2.11.9 COMPARISON OF TRANSPORTATION SYSTEMS OF CITIES

In this section, the City of Kigali is benchmarked against several cities to identify gaps, which exist in the current transport system. The City is benchmark against Singapore for its world-class land transport system, Curitiba and Bogota for its efficient public transport system. As the vision is to become Centre of Urban Excellence for Africa, Kigali is also benchmark with Cape Town and London as they are the main economic hubs of the sub-Sahara Africa and the world respectively.

	KIGALI CITY	Singapore	CAPE TOWN	Curitiba	BOGOTA	LONDON
POPULATION	1.22 MILLION (2012)	5,183,700	Сіту = 827,218, Метко = 3,497,097	MUNICIPALITY = 1,764,540, METRO = 3,209,980	6,840,116	7,825,200
Area (KM2)	731.27	710	CITY = 496.7, METRO = 2,454.72	MUNICIPALITY = 430.9, METRO = 15,416.9	1,587	1,570
Density (per km2)	1,165.8	7,315	CITY = 1,700, METRO = 1,400	MUNICIPALITY = 4,062, METRO = 210.9	4,300	4,978
NATIONAL GDP PER CAPITA (USD)	605	49,271	8,066	12,789	7,132	38,592
Urban Transport System						
PUBLIC : PRIVATE	80: 20	59 : 41	48 : 52	61:39	75 : 25	57 : 43
CARS /1000 PERSON	40	114	200	400	NOT AVAILABLE	330
Length of Expressway (km)	0	161	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	60
Percentage of Paved Road	< 20%	100%	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
CONNECTIVITY FROM CITY TO INTERNATIONAL TRANSPORT TERMINAL (E.G. AIRPORT, IN- TERNATIONAL RAILWAY STATION) BY DRIVING (MIN)	NOT AVAILABLE	20	20	NOT AVAILABLE	40	30-45
Average Commute Time (min)	NOT AVAILABLE	36	32	67	35	35 (2006)
PUBLIC TRANSPORT						
Spacing between bus stops (m)	NOT AVAILABLE	400	NOT AVAILABLE	880 - 1175	700	NOT AVAILABLE
Length of Dedicated Bus Lane (km)	0	178	NOT AVAILABLE	244	134	240
NON-MOTORISED TRANSPORT						
LENGTH OF CYCLEWAYS (KM)	0	116	16	250	300	683
PROVISION OF PEDESTRIAN WALKWAY	CURRENTLY AD HOC	AT ALL DEVELOPMENT-SIDE OF THE ROAD	NMT LANES, FOR BOTH PEDESTRIAN AND CYCLIST,			
RUN PARALLEL TO THE NEW MYCITI BUS LANES	PEDESTRIAN MALL AT TRANS- PORT HUB	AT ALL DEVELOPMENT-SIDE OF THE ROAD, PEDESTRIAN STREETS AND MALLS, OVERHEAD CONNECTION TO BRT	At all development-side of the road			
SAFETY						
Fatalities on the Road per 100,000 pop	27.7	3.8	37.8	5.1	7.1	1.6
Environmental						
CARBON EMISSION (CARBON DIOXIDE EMIS- SION PER CAPITA)	1.6	7	CITY = 11.7, METRO = 5.8	2.1	NOT AVAILABLE	9.6

Table 2.15 Transportation Case Studies & Benchmarking


Fig.2.68 City of Kigali – Existing Water Source Map

2.12 Water Supply

Potable water supply in the City of Kigali is supplied by EWSA, a state- owned public utility Company for the production, transmission and distribution of water and electricity in Rwanda.

2.12.1 WATER SOURCE

There are three main water sources that supply to the City. They are Yanze River, Nyabarongo River and Lake Mugesera (refer to Fig.2.68). The seasonal yields of these water sources are unknown. For long term planning purpose, it is recommended that detailed studies be carried out to establish the potential yields. Besides these 3 sources, some of the residents get water from bore well and springs.

Spring water from Mutobo, Muzanse District, is being considered by EWSA to augment the existing water supply sources. The planning process is still ongoing. The new water source is expected to supply 120,000 m³/day of water for the City of Kigali and the surroundings upon completion in 2017.

2.12.2 WATER TREATMENT PLANT

There are 3 water treatment plants that supply potable water to the City:

 KIMISAGARA WATER TREATMENT PLANT (WTP) – The 30-year-old plant draws its raw water supply from Yanze River. The treatment method is based on the conventional clarification-filtrationchlorination system. Currently, it has reached its ultimate design capacity of 22,000 m³/day. It supplies mainly to the Nyarugenge District and several sectors in Gasabo and Kicukiro District such as Kimicanga, and part of Kacyiru.

- NYABARONGO WTP The plant treats ground water from the well field in the flood plain on the east bank of the Nyabarongo River. It uses rapid filtration system followed by chlorination. The current capacity is at 25,000 m³/day and would be upgraded progressively to produce 40,000 m³/day of potable water in the future. It supplies to the entire city with the exception of the eastern part of Gasabo and Kicukiro District.
- KARENGE WTP The plant draws its raw water supply from Lake Mugesera. It uses conventional treatment method that consists of coagulation, flocculation and clarification to treat the raw water. It is producing 12,000 m³ of potable water daily. It supplies mainly to Kicukiro, Masaka and part of Remera & Kanombe.

2.12.3 WATER DISTRIBUTION

Potable water supply from the 3 water treatment plants is stored at various water storage tanks installed within the City. It is then distributed through EWSA's piped water network to the residents. Pumping stations are in place to maintain the optimum pressure in the water network.

Water supply network expansion is planned and carried out by EWSA based on the demand from the users. New users will have to apply and pay for water connection directly to EWSA.

In the past, the water network extension was not planned according to the future land use or growth. Hence, there are many existing pipes that do not follow the road alignments and encroach into property boundaries. This has made maintenance

work more difficult to carry out.

The piped water network covers most of the built-up area in the City (refer to Fig.2.69). Urban areas that are closer to the City Centre such as Muhima, Nyarugenge, Gitega, Kimisagara, Kimihurura, Gikondo, etc. have the most extensive piped water network. Connections to households are available for the residents in this area.

Residents without indoor plumbing connection get water from the public tap stands using jerry-cans. The tap stands water is supplied from the municipal water supply network. The average distance from the residential area to the public stands is about 280m. The city-wide goal is to increase the number of tap stands so as to shorten the walking distance to 250m.

Some sectors are situated further away from the existing water supply network or have low population density that makes it uneconomical for water network extension. The residents usually get water from the water kiosks, streams or bore-holes.

2.12.4 WATER CONSUMPTION

The extensive water network and the existence of public facilities and newer residential developments in the urban area encourage higher water consumption. Water consumption at larger homes, office buildings and tourism facilities could reach as high as 200 lpcd (litre per capita per day).

Residents at the informal neighbourhoods with no access to indoor plumbing such as Kacyiru and Rusororo have lower water consumption that ranges from 15 - 25 lpcd.

In view of the unbalanced water

consumption rate in the City, the Ministry of Infrastructure (MININFRA) has initiated a city-wide goal of 80 lpcd. At present, EWSA supply an average of 45 lpcd of potable water to the City.

2.12.5 KEY ISSUES TO BE ADDRESSED

Some of the key issues that are to be addressed by the City include:

- UNCOORDINATED PLANNING BETWEEN FUTURE LAND USE AND INFRASTRUCTURE: Without proper planning, the existing infrastructure would not be able to meet the growing water demand. The City has to work closely with the service provider to determine the growth centre and the projected water demand. Sufficient land should be set aside for the construction and expansion of the water treatment plants and service reservoirs.
- SHORTAGE OF WATER SUPPLY: The current supply is still lacking behind the actual demand. The 80 lpcd city wide goal set by the MININFRA was due to the limited supply. In the long run, as the City population and standard of living rise due to the urbanization, this goal has to be reviewed. The City also has to utilise the current resources more efficiently and identify new ones for long term planning. Potential water resources such as Lake Muhazi, Ruhengeri volcanic formation, Cyuga and Byimana sources have been identified in the Kigali City Master Plan (KCMP). Mapping and feasibility study should be carried out on these sources to determine their potential yields.



Fig.2.69 Existing Water Network Map Source: EWSA

LEGEND

Tap Stands Existing Water Reservoir Planned Water Reservoir Water Source Junction & Vanne Pumping Station TP Water Treatment Plant FD Water Pipe AB Water Pipe PE Water Pipe **PVC Water Pipe** AG Water Pipe Road = Manhole Antenna Boundary Proposed Antenna Boundary References Buildings



• DIFFICULTY IN EXPANDING THE WATER NETWORK: The undulating terrain of Rwanda poses a challenge in laying and expanding the existing water pipe network to cover the entire City. It is more economically viable to consider local water supply sources for areas that are inaccessible to the existing network.

2.13 Waste Water

There is no institution that is solely responsible for wastewater planning and management in the City of Kigali. At the moment, REMA (Rwanda Environment Management Authority) and RURA (Rwanda Utility Regulatory Authority) function as regulators for the implementation of sewerage systems in new developments.

2.13.1 SEWAGE TREATMENT

Currently, there is no sanitary sewer network or a centralized sewage treatment plant (STP) in the City of Kigali. 2 main



Fig.2.71 Compartment to Separate Human Waste in EcoSan

Fig.2.70 Contaminated Drains Map Source: Sewerage Master Plan

domestic sanitation systems that are widely used in the City are:

- SEPTIC TANKS Septic tanks are widely used in the urban areas. Effluent from the septic tank is directed into the leech field. The City operates three pumpers to handle and dispose of the sludge from the septic tanks at the landfill at Nyanza.
- PIT LATRINES Traditional soak away pit latrines and ventilated pit latrines are the most common types. Pit latrines are commonly used in informal settlements and rural areas without piped water supply. In some areas with high ground water table, the use of pit latrines has been found to contaminate the ground water.

ECOSAN (ECOLOGICAL SANITATION) toilet has been implemented in several public schools in the City (refer to Fig.2.71). It provides an economical and hygienically safe system to separate and recycle the urine and faeces back into the environment through

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agriculture.

The funding for the EcoSan construction comes from the NGO (Non Government Organization) while the District Office provides the man power required. The long term goal is to equip all the public schools in the City with EcoSan.

Despite all the effort to treat the sewage at the household level, raw sewage discharge into the public drain and water bodies is still happening in the City. Recent study on water quality in public drains in the City found that most of the drains are contaminated with both sewage and industrial wastewater (refer to Fig.2.68 for the location of the contaminated drain).

2.13.2 ON-SITE STP

There are a few small developments that treat their sewage onsite, such as Hotel des Milles Colline and Centre Hospitalier de Kigali (aerobic with activated sludge), Muhima Maternity Hospital (biological filter), Caisse Social 20/20 Estates (rotating biological contactor and Caisse Social Kacyiru (conventional aerobic digestion with effluent chlorination). The Treated Sewage Effluent (TSE) from these onsite STPs is discharged into the public drains while the sludge is disposed of at the landfill at Nyanza.

Recently, RURA has formulated a policy that regulates all new high density developments such as hotels, real estate developments and residential neighbourhood to have their own temporary on-site STP. REMA would review the STP system proposed by the developer. REMA would also conduct a periodic check to ensure all the new developments comply with the policy.

Developer can only commence the

construction work upon obtaining the certificate from REMA, to certify that the new development would not cause any environmental hazard to the surroundings.

With respect to the new policy, the City is planning to build a temporary STP next to Avenue des Poids Lourds to serve the proposed CBD 1 Phase-1 development. Upon completion, it would be the biggest temporary STP in the City with treatment capacity of approximately 700 m³/day.

2.13.3 INDUSTRIAL WASTE WATER

Sulfo Rwanda is one of the manufacturing and trading companies in Nyarugenge Market in Muhima Sector which produces detergents, cosmetics, mineral water, etc. It generates both industrial and domestic wastewater. Two filtration pits are used to treat the chemical waste while septic tanks are used to manage the sewage.

Wastewater from other industrial facilities is not known to be treated. It is usually discharged into public drains which end up contaminating water bodies such as rivers and wetlands.

Although Rwanda's Organic Law requires industries to have on-site treatment facilities before discharging their wastewater, it is usually not enforced.

2.13.4 SEWERAGE MASTER PLAN

The Sewerage Master Plan for the City of Kigali was completed in March 2008. The study areas covered by the Master Plan only include Muhima, Nyarugenge, Kacyiru, Kimihurura, Kigarama, Kimironko, Remera and Narugunga (refer to Fig.2.72).



Fig.2.72 Map showing catchment area of the Gitikinyoni STP Source: Sewerage Master Plan



Fig.2.73 Existing Watershed and Drainage Map Source: KCMP

The master plan has proposed to build a centralised STP with an estimated daily treatment capacity of 27,000 m³ at Gitikinyoni to treat sewage from the specified sewerage catchment by year 2020.

RURA and REMA have not agreed on the proposed STP location at Gitikinyoni as the area is currently a low lying marshland with flooding problem. Discussion is still ongoing to identify a more appropriate location for the STP. EWSA would then coordinate the tender calling for the STP construction.

Upon completion of the centralised STP, all the household and temporary onsite STP within the catchment would be connected to Gitkinyoni STP by sewer network for collection and treatment.

2.13.5 KEY ISSUES TO BE ADDRESSED

Some of the key issues to be addressed by the City are as follows:

- Selection of an appropriate site for the centralised STP: The site that is currently being considered by the City is susceptible to flood. It would cause several issues to the STP operation such as overflowing of sewage into the surroundings and damage to the pumps. The City may need to consider another site or prepare mitigation measures to keep the STP running smoothly in the event of flood.
- Direct discharge of sewage into the existing water bodies: It will not only contaminate the water quality in water bodies but also pose a threat to public health. The City needs to progressively phase out septic tanks and pit latrines in

the urban areas and provide adequate STP and sewer connections to curb the problem of direct sewage discharge..

 Contamination of ground water by pit latrine: As the sewage infiltrates the soil, it will need time to be treated by the organisms and cations in the soil. Most of the contamination cases usually occur at the areas with high water table or near the water bodies when the sewage has shorter retention time in the soil. The use of pit latrines at these areas needs to be prohibited in the future and be replaced with more environmental friendly system.

2.14 Storm Water

The storm water drainage system in the City of Kigali is constructed and maintained by the Infrastructure Department of the City.

2.14.1 STORM WATER CATCHMENT

The City of Kigali has an annual rainfall of 1,000mm with April being the wettest month and July the driest.

Topographically, storm water runoff from the City is divided into 2 major catchments – northern and southern catchments. The northern catchment drains into Nyabugogo River then into the Nyabarongo River to the west of the City while runoff from southern catchment drains directly into the Nyabarongo River in the south (refer to Fig.2.73). In general the northern catchment area is steeper than the southern catchment area.

2.14.2 EXISTING STORM WATER DRAINAGE

The existing drains in the City of Kigali are usually constructed on one side of the road and the ones in the City centre are mostly covered. In general, the existing drainage network in the City consists of 3 types of drain structure:

- **OPEN MASONRY STORM CHANNELS** mostly with cascades due to the steep slope (refer to Fig.2.74);
- COVERED MASONRY STORM CHANNELS mostly with cascades due to the steep slope (refer to Fig.2.75);
- UNLINED NATURAL CHANNELS which are subjected to high erosion (refer to Fig.2.76).

Most of the existing structured channels are well constructed and have adequate drainage capacities. However, some of the channels are damaged and need to be rehabilitated.

In some places within the City, the channels are located along steep natural earth slopes, hence, there is a high possibility that the soil might slide into the channel and be deposited further downstream in the natural wetlands and eventually the rivers. The eroded slopes and valleys in many areas could result in landslides which would threaten life and damage property.

The lack of covers over drains allows residents to dispose of their waste water and solid waste directly into the drains. During a storm event, the naturally steep drains cause all the waste materials to be washed down and accumulated at the receiving water bodies.

The absence of sewerage network and proper on-site treatment has prompted the discharge of sewage into public drains. This in turn reduces the capacity of the drains and creates health problem to the residents.

At areas where there is no proper drainage system, temporary ditches are constructed by the residents to prevent storm water from flowing into their homes.

Eventually, rapid urbanization of the City would cause higher storm water runoff, and if proper storm water management measures are not taken, would lead to increased erosion and flood problems.



Fig.2.75 Covered Masonry Drain



Fig.2.74 Open Masonry Drain



Fig.2.76 Unlined Natural Channel



Fig.2.77 The Study Area of the Storm Water Master Plan. Source: Storm Water Master Plan

2.14.3 STORM WATER MASTER PLAN

The Storm Water Master Plan for the City of Kigali was completed in March 2008. The study areas covered by the Master Plan include 10 different rivers located at Mpazi, Rwampara, Ruganwa, Kibumba, Rugenge, Rubilizi, Busanza, Mwanda, Nyagasenyi and Kagugu (refer to Fig.2.77).

The Master Plan has proposed some measures to improve the storm water management of the City of Kigali such as rehabilitations and clean-up of the existing drainage network, formulation of storm water management policy, etc.

2.14.4 KEY ISSUES TO BE ADDRESSED

Some of the key issues to be addressed by the City are as follows:

- LACK OF SEPARATION BETWEEN STORM WATER AND WASTE WATER FLOW: It is affecting the water quality in the public drains and eventually the receiving water bodies. To resolve this issue, close coordination with the implementation of the sanitation policy and proper sewage treatment system is necessary.
- MAINTENANCE AND UPGRADING OF THE DAMAGED CHANNELS: Damaged channels will not function at their optimum design capacity, which may cause localised flooding in the event of heavy rain. The City has to conduct regular checks and maintenance of the existing drains to ensure that they are in good conditions.

- LACK OF STORM WATER MANAGEMENT: Storm water should be seen as a resource to be valued and not to be got rid of. As the City has a considerable amount of rainfall annually, with proper storm water management, it could be harvested for non-potable use such as landscape irrigation and general area washing.. Besides, providing an additional water resource, proper storm water management (e.g. rainwater harvesting and storm water retention) would also help to reduce flood risks.
- LACK OF PROPER DRAINAGE DESIGN GUIDELINE: Without a standard local design guideline, there would not be a common basis for designing drains in the new developments or for verifying the adequacy of the drainage capacities of the receiving drains and canals. With the rapid urbanization process, and for proper development control, a local standard guideline with relevant rainfall data should be established.
- EROSION AT THE AREAS WITH STEEP SLOPES; Gikondo Industrial Area and Nyamirambo area on the eastern slopes of Mount Kigali are some of the examples of such problematic areas. The eroded soil would eventually end up in the water courses and water bodies, thus reducing the drainage capacity and polluting the water environment. Earth control measures such as afforestation, soil terracing, contour farming, etc should be implemented to minimise soil erosion.

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2.15 Solid Waste

Solid waste management in the City of Kigali is taken care by the Infrastructure Department of the City in collaboration with informal players such as the Women's Association and Community Based Organization (CBO).

2.15.1 WASTE GENERATION

The current solid waste generation rate in the City of Kigali is approximately 0.6 kg/ cap/day, as reported in the Kigali Concept Master Plan (KCMP). With the existing total population of approximately 1,060,000 (2010), the City of Kigali generates 640 tonnes of waste daily. There are 3 main categories of waste generated in the City:

• ORGANIC WASTE – Biodegradable waste is the main type of waste generated in the City. Examples of organic waste are food waste, biomass and garden waste. They are usually disposed of directly into the landfill. Recycling and re-use of organic waste have been initiated although they are still at very low levels.

- NON-ORGANIC WASTE Plastic, paper, glass, metal, and combustibles are the most common non-biodegradable waste. Recycling of non-organic waste is not common. However, the City Council had banned the use of plastic bag within the City to reduce the amount of plastic waste.
- HAZARDOUS WASTE Any waste that poses threat to human health and the environment is classified as hazardous waste. They are mainly generated by hospitals, industries and other facilities. Currently, hazardous waste is disposed of at the municipal landfill together with other types of wastes. Some hospital and industries incinerate their wastes on site.

2.15.2 WASTE DISPOSAL

All the waste generated in the City of Kigali is disposed of at the only existing municipal landfill at Nyanza which is already operating at full capacity (refer to Fig.2.78 and Fig.2.79). Solid waste is collected from individual buildings and transported to the



Fig.2.78 Nyanza Landfill



Fig.2.79 Map showing Location of the Existing and Proposed Landfill Source: Topographic and Geotechnical Survey Report by WAT

landfill by private haulers with roll-off bin containers on a weekly basis.

There is no proper waste treatment facility to sort and treat the waste before disposal at the landfill. Data from KCMP report indicates that only 60% of the waste generated is disposed of at the landfill while the remaining 40% is recycled or disposed of at various locations in the City. The typical charges for dumping waste to the landfill range from 2,000 – 5,000 Rwf per trip, depending on the types of hauler vehicles.

The City Council has imposed a law prohibiting any waste dumping outside one's plot. Community Based Organization (CBO) was founded to provide the residents with solid waste management services. Certain amount of fees is charged for the service.

CBO operates at the neighbourhood level and is found at Nyarugenge, Gitega, Muhima and Kimicanga. It has improved and raised awareness of the importance of urban solid waste management.

Since the operation of the CBO, there have been fewer activities of illegal dumping of solid waste into the public drains. Most big institutions and businesses in affluent areas are served by more costly private solid waste management companies.

Preliminary site inspection carried out by consultants from the City of Mainz, Germany indicates that the current landfill does not meet the current standard for sanitary landfill as it is unlined and does not have a leachate control system. Several problems have also been identified within the landfill, such as:

- HIGH RISK OF LANDSLIDE INTO THE SURROUNDING RESIDENTIAL AREA – The steepness of the landfill slopes and lack of buffer distance between the landfill and the residential area contribute to the risk of landslide in the future.
- CONTAMINATION OF THE EXISTING WATER BODIES – Leachate from the landfill is estimated at 17,000 m³/year. Due to the lack of proper leachate control system, it is currently seeping into the Nyacyonga River, at the downstream of the landfill.
- LEAKAGE OF LANDFILL GAS Methane is the main gas produced in landfills. This combustible gas generates toxic fumes and may intoxicate the residents due to the current lack of containment system for landfill gasses.

2.15.3 ONGOING PROJECT

The City of Kigali is planning to construct a regional sanitary landfill and recycling centre to replace the existing Nyanza Landfill. The proposed 11-ha site is located 2.6km in the east of the brick factory Ruliba, Nyarugenge District (refer to Fig.2.80). The new landfill would serve the entire City of Kigali.

Geotechnical and Topographical surveys for the detailed design and supervision of the construction works of the new landfill and recycling centre were completed in December 2011. EIA and detailed design for it are still in progress.

RURA and REMA have not agreed on the proposed site as it was too near to the City centre. In addition, it was located near Nyabarongo River, the City's main raw water source, hence increasing the possibility of contamination from the landfill.

While the City is still selecting the most suitable location for the regional landfill site, the waste is being disposed of in the temporary landfill at Nduba, Gasabo District (refer to Fig.2.79 & Fig.2.80) to reduce the load on the Nyanza landfill which is already operating beyond its design capacity.

2.15.4 Key Issues to be Addressed

Some of the key issues to be addressed by the City are as follows:

- SELECTION OF REGIONAL LANDFILL SITE: The site that is currently being considered by the City has several limitations such as its proximity to the City Centre and Nyabarongo River, one of City's main water sources. Higher priority needs to be given to this project as Nyanza landfill is already operating beyond its design capacity. Ideally the landfill site should be located away from the population. It should be properly lined to prevent the leachate from infiltrating and contaminating the ground.
- PROPER CLOSURE OF THE EXISTING NYANZA LANDFILL: If the landfill is not properly closed, there is a high possibility of a build-up of combustible methane gas within the landfill which would lead to a sudden explosion, and also groundwater contamination by the leachate. Therefore, a landfill specialist should be engaged to plan and execute the closure and rehabilitation of the Nyanza landfill. The closed landfill site can be rehabilitated for use as low density developments such as parks, open communal spaces and



Fig.2.80 Site preparation work for Nduba Landfill

recreational areas. Hence, as part of the city master plan, the City could take into consideration the potential land use of the rehabilitated landfill site.

• LACK OF PROPER SOLID WASTE MANAGEMENT SYSTEM: The current Nyanza landfill does not have proper engineered lining to prevent leachate from contaminating the ground. It also has no solid waste treatment facility to segregate the various types of wastes and treat them accordingly. It is recommended that such functions should be provided for in the future landfill site. To increase the life span of the landfill, waste recycling should be encouraged at various stages before disposal at the landfill.

2.16 Power Supply

The power supply is an important sector as it is directly linked to the other sectors of the economy. In Rwanda, there are abundant power resources, such as hydropower, solar, geothermal, and other forms of renewable energy, yet there is widespread power insufficiency in the country. According to a report in 2009, the grid access covers only 5% of the whole country. Out of this, the City of Kigali consumed about 61.5% of the total electricity supply.

The Department of Energy, within the Ministry of Infrastructure (MININFRA) is responsible for the policy making for the energy sector in Rwanda. Electrical power generation, transmission and distribution in the City of Kigali is taken care of by EWSA, a state- owned public utility company for the production, transmission and distribution of water and electricity in Rwanda.

2.16.1 POWER SUPPLY SOURCES

Power supply in Rwanda comes from 3 main sources:

- Hydropower plant (57%);
- Thermal power plant (38%);
- Imported power (15%).

The 4 main hydroelectric plants in Rwanda are Mukungwa, Ntaruka, Gisenyi and Ghira. Nyabarongo and Rukarara are the nearterm projects to be connected to the grid. In addition, Rwanda has 333 potential sites for micro hydropower plant.

The second national power source is thermal power. The 4 thermal power plants in Rwanda are Jabana1, Jabana2, Aggreko 1 (Gikondo) and Aggreko 2 (Mukungwa).

The imported power comes from Rusizi I and II hydroelectric facilities which are owned in equal shares by Burundi, the Democratic Republic of the Congo (DRC) and Rwanda.

2.16.2 POWER SUPPLY NETWORK

The national electricity grid consists of 30 kilovolt (kV), 70 kV and 110 kV overhead transmission lines.

There are 4 electrical substations serving the City of Kigali (refer to Fig.2.81). They are located at Jabana, Gikondo, Mount Kigali and Gasogi. Electricity would be transmitted to these substations before it is distributed to the grid through the distribution line consisting of 15kV, 6.6kV and Low tension 400V overhead power lines.

EWSA is conducting the grid audit and the whole process is targeted to be completed by 30 April 2013. At the same time, EWSA will install SCADA (Supervisory Control and Data Acquisition) System to improve the system management and monitoring on the power supply system.

2.16.3 FUTURE NATIONAL ELECTRICITY PLAN

All the future plans for Rwanda are summarized in a 7-year Development Plan (2011-2017) as follows:

- Connect 1.7million customers to the power grid;
- Production of additional 1.000MW of power by 2017 from various sources such as Hydropower (232MW), Geothermal (310MW), Methane (300MW) and Peat (200MW);

- Expansion of the existing power line by laying 2,100km long transmission line;
- Construction of hydropower plant in Nyabarongo (28MW) by 2014;
- Construction of hydropower plant in Rusizi III (145MW) and Rusizi IV (287MW);
- Preparation of Peat Master Plan;
- Reserve of 25-ha of land at the eastern province for the development of solar energy;
- Privatization of the existing small hydropower plant.

Rwanda possesses geothermal resources in the form of hot springs along the belt of Lake Kivu with a power generation potential of about 170-320 MW. Preliminary technical exploration studies are currently being conducted. Once the resource assessment is completed, good potential sites can be developed by the private sector.

In the near future, the source of electricity could be from methane gas that can be extracted from Lake Kivu. Around 555 billion cubic meters of methane gas are dissolved in the lower layers of Lake Kivu that can be used to produce power. A small pilot plant that is currently feeding 2 MW to the national grid has been developed by the Government of Rwanda. The pilot plant has proven that conversion of methane gas to electricity is technologically feasible.

The details of a project to convert methane gas to electricity in a large scale in Rwanda are as follows:



Fig.2.81 Existing Substation in Kigali

- Location: Lake Kivu
- Company in charge: Kivuwatt
- Power generation target: 25MW (1st Phase) and 75MW (2nd Phase)
- Generation potential: 700MW for about 55 years
- Power to be shared with Democratic Republic of Congo

2.16.4 Key Issues to be Addressed

Some of the key issues to be addressed by the City are as follows:

- LOW ACCESS TO ELECTRICITY IN THE RURAL AREA: Alternative energy sources should be considered for areas that are not close to the national grid.
- LACK OF UTILITY RESERVE ALONG PUBLIC ROAD AND LAND SPACE FOR POWER INFRASTRUCTURE: Due to uncoordinated planning between land use and infrastructure, there is often insufficient space to lay power cables within the road reserve and/or no suitable plots to build electrical substations. In most cases, additional cost is incurred

to acquire land for the construction of substations and/or divert the existing utility services to provide space for the new power cables. Sufficient land and utility reserves need to be set aside while planning for future growth and land use,

2.17 Infrastructure Comparisions

INFRASTRUCTURE

This chapter presents the key findings of the infrastructure system focusing on water & sanitation, storm water, solid waste management and power supply in 4 global cities in the world: Singapore, Cape Town, Australia and Melbourne. The results of the implementation of the various policies and strategies adopted by these 4 cities are compared in Table 2.16 and serve as a benchmark in setting realistic targets for the City of Kigali to develop its future infrastructure system to a higher standard in order to position itself as a world-class modern and progressive City.

	KIGALI CITY	Singapore	CAPE TOWN	Amsterdam	Melbourne	Remarks			
			WAT	ER SUPPLY					
WATER LEAKAGE	40%	5%	10%	4%	12%	Water leakage is usually referred to as physical loss. It refers to			
WATER SUPPLY / DEMAND	45 lpcd	155 lpcd	225 lpcd	147 lpcd	142 lpcd	through the faulty distribution system. Water leakage not only causes waste of money but is also a waste of resources			
Access to Water Supply	92%	100%	91.4%	100%	100%	especially in water-deprived cities. The average global water leakage is estimated at 10 – 30% for developed cities.			
	Sewerage								
Access to Sewerage Network	N.A	100%	94%	99%	100%	Providing adequate sanitation is very important in promoting public health through prevention of human contact with sewage. Therefore, 100% sewage coverage for the entire population is expected of a developed city.			
			Stormw	ATER DRAINAGE					
Sustainable Storm Water Management Practice	N.A	Active Beautiful Clean Water	N.A	N.A	Water Sensitive Urban Design	Traditional storm water drainage practices rely on concrete canals to convey storm water runoff into existing water bodies to prevent flooding. While it is very efficient for flood prevention, it increases the risk of flash floods downstream. Sustainable storm water management practice aims to improve runoff quality and reduce runoff velocity to alleviate risk of flash flooding on the downstream network and receiving water bodies.			
			Sol	ID WASTE					
Solid Waste Generation Rate	0.6kg/person.d	0.89kg/person.d	1.57kg/person.d	1.33 kg/person.d	0.97kg/person.d	Solid waste generation rate refers to the municipal waste generated by each person daily. It varies from country to country depending on the economic situation, life style and regulations. The City of Kigali is currently generating solid waste at a rate much lower than the global average. Therefore effort should be made to maintain it below global average even with economic growth and more affluent lifestyle.			
RECYCLING RATE	N.A	51%	30%	43%	70%	Recycling helps to reduce the amount of waste to be disposed of at the landfill, prolong the lifespan of the landfill and reduce the release of carbon dioxide gas from the waste combustion process.			
			Pow	ER SUPPLY					
POWER NETWORK COVERAGE (BY POPULATION)	N.A	100%	89.7%	100%	100%	Adequate power supply is one of the important drivers for social and economic development. For a developed city, 100% of the population should have access to the power grid.			

Table 2.16 Infrastructure Benchmarking

SINGAPORE

Singapore has successfully provided reliable and good infrastructure to its people, especially a high quality of water supply despite the lack of natural water resources. Its success in the development of NEWater, an ultra pure recycled wastewater, is a breakthrough in the water recycling industry. It has taken initiative to develop a sustainable storm water management program to treat the storm water runoff at the source while bringing people closer to water by creating new recreational and community centre for the people. Its integrated solid waste management project has also been instrumental in creating the clean environment that can be enjoyed by all the residents. Due to its limited natural resource, Singapore relies on imported oil and natural gas to produce electricity.

CAPE TOWN

Cape Town is the second largest city in South Africa after Johannesburg. It has a high water consumption, compared with the average African City. It aims to reduce its water consumption by curbing water leakage and has an ongoing programme to help the poorer household to reduce high water bills by fixing water leakage themselves. It has a long term program to upgrade all the existing waste water treatment facilities to meet the national wastewater management standards. To reduce waste, it encourages public and business to exchange potentially useful waste materials. Recycling facilities are widely available with on-site and central collection points. The city relies heavily on coal to produce 93% of its power supply.

Amsterdam

Amsterdam is one of the top performers in the European Green City Index. It has low water consumption, half the average water consumption of other European cities despite the abundance of water. It has also managed to keep its water leakage below 5%. Amsterdam recycles almost half of its waste. Many of the city buses use fuel which is generated from waste. It has one of the most energy-efficient district heating networks in Europe.

MELBOURNE

Melbourne is one of the pioneers in developing the Water Sensitive Urban Design (WSUD) concept to integrate water cycle management into urban planning and design. As water is a limited resource, proper water cycle management is an important factor to create an ecologically sustainable city. It has been successful in achieving a high recycling rate, thanks to the various recycling programs and the construction of the waste and recycling centre. 33% of Melbourne electricity comes from renewable sources such as wind energy, solar power, sewage, etc.

2.18 Development Constraints and Opportunities

Kigali's key physical constraints and opportunities are identified based on the existing context analysis. The key objective of identifying the Kigali's development constraints and opportunities are to understand the site constraints that are required to be respected as given site conditions, and to optimize the potentials offered by the site which shall be considered for the new city Master Plan.

2.18.1 Key Development Constraints

More than half of the City's land area is constrained by natural limitations. Other physical constraints include some of the existing site uses and the recently approved projects especially around the urban areas.

DEVELOPMENT CONSTRAINTS IMPOSED BY ENVIRONMENTALLY SENSITIVE AREAS

- 19% of the Kigali is occupied by the wetlands and these environmentally sensitive areas require to be respected. Large areas of these wetlands are spread along the southern and western boundaries of the City along the Nyabugogo river. As per the organic law, all wetlands and natural water bodies need to be provided with 20m buffer which is restrained from development.
- The City is also constrained with geographical terrains largely in Gasabo and Nyarugenge districts. Around 31% of City's land falls under the "Steep Slope" Category, which is the land with a slope of more than 20%. This further leaves just about one-third of land available for development. These steep slope areas are environmentally sensitive and needs to be restrained from urban development.

DEVELOPMENT CONSTRAINTS IMPOSED BY EXISTING AND APPROVED DEVELOPMENTS

- Currently, 7% of the City's land is taken up by unplanned developments without proper access to roads, infrastructure services and public facilities. While it is essential to either improve or redevelop these urban areas, some of it may remain as constraints due to limited City resources. A different urban strategy will be required to improve the living conditions within these unplanned areas.
- Further to this, around 1% of the city area is occupied by good class single family housing mostly around the prime areas in proximity to the city core which potentially could accommodate much higher densities. These houses will require to be retained due to its well established high end neighborhood character.
- Other strategic high value areas in Gikondo are also occupied by pollutive industries and the dry port. These will need to be relocated in the long term to rationalize the use of such prime land in close proximity to the Citey centre.
- While the City is growing fast with number of new development projects; most of the approved residential projects such as Cyaruzinge, Nyagahanga, Gisozi, Kinyinya, Gaciliru and Rukatsa including the industrial development project at Kigali SEZ are proposed in the strategic areas along east west corridor but with very low densities. Hence, these proposals constrain the optimal development potential of these sites.
- The current airport at Kanombe constrains the air space of the urban area around it due to the height restriction imposed.
- Special uses such as military land also restrict the new development in that area.



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ake Muha LEGEND Low density Imudugudu urban area High density unplanned Existing well established low density development Industrial development in wetlands Strategic high value areas in proximity to CBD currently occupied by ndustrial & dry port Existing SEZ area Military bases 1.000 Height restriction improsed by airport limits high density development Land under category of steep slope Wetlands (11%) Sector Boundary District Boundary



2.18.2 Key Development Opportunities

The City is blessed with a scenic naturescape and a pleasant salubrious climate. Sizeable areas of land are free of development and available especially in the Gasabo and Kicukiro districts for the urban expansion.

AMPLE STRATEGIC AREAS FOR NEW DEVELOPMENT

 A total of 266 sq km or 36% of City's land is developable in the City of Kigali out of which 17% is currently occupied by the existing urban developments. Around 153 Ha of virgin land along the north and south of the EW corridor is available for new urban developments.

OPPORTUNITIES FOR URBAN REDEVELOPMENT

 67 Ha of land is currently occupied by unplanned settlements and low density urban areas and have the potential to be redeveloped as the comprehensive high density urban areas for housing and commercial developments with integrated public facilities and infrastructure services.

REVITALIZATION OF CENTRAL BUSINESS DISTRICT

The tri-nodal existing CBD constitutes of Nyarugenge and Muhima (Commercial zone), Kacyiru (Administrative zone) and Kimihurura (Diplomatic zone) can be further strengthened and fortified as the premier business district of Rwanda.

OPPORTUNITIES FOR NEW EMPLOYMENT NODES

• Approved international railway lines connecting Kigali to Dar- Es - Salaam and Musongati provide greater opportunities for logistic and industrial activities in Kigali City. The rail line is planned to be extended further to the north towards Uganda in future.

- There are some existing scattered industrial development around Gatsata along the Kigali- Gatuna Road in the northern part of Gasabo.Hence, the scattered industries could potentially be consolidated and safeguarded as expanded employment node with variety of industrial and logistics development.
- The approved rail line passes through Masaka, connects to the Kigali SEZ and are also proposed to connect to the upcoming international airport at Bugesera south of Kigali which further increases the opportunities for air cargo. This provides the opportunities for developing logistics for perishable goods around Masaka.
- The current mixed use pattern along the EW road provides opportunities to develop this corridor as a high density mixed use development corridor.

POSSIBILITIES OF REGIONAL PASSENGER RAIL

• There is a possibility of extending the upcoming freight rail to a passenger rail connecting the CBD.

IMMENSE POTENTIAL FOR RECREATION AND TOURISM

- Hilly areas in Nyarugenge & Gasabo are potential for recreation & unique urban agriculture. The steep slope areas also offer potential opportunities for afforestation and expansion of green areas for the dense urban developments.
- Large wetland in the south could be transform into an attractive wetland park. The redevelopment opportunities also offer potentials for restoration of former wetlands.

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3 DIMENSIONS OF GROWTH

Table 3.1 National economic and employment growth over the last five years

2010	OUTPUT		EMPLOYMENT		
Sector	RWF bn.	5-year growth	TOTAL	5-year growth	
AGRICULTURE	1,205	4.70%	3,600,000	1.10%	
INDUSTRY	482	8.60%	506,000	13.00%	
Services	1,589	9.80%	823,000	6.30%	
TOTAL GDP	3,277	7.60%	4,960,000	3.60%	

Source: National Institute of Statistics, GDP Estimates 2010/11 and EICV-III Household Survey data

Table 3.2 Current GDP & Employment by Sector for Kigali, 2010-2011



Source: National Institute of Statistics, GDP Estimates 2010/11, 2005 prices

Table 3.3 Projected Economic Growth Rate for Rwanda, 2011-2040

RWANDA PROJECTED ECONOMIC SCENARIOS						
	2011	2020	2040			
LOW CASE	7.6%	7.1%	6.1%			
MEDIUM CASE	8.1%	7.7%	6.9%			
HIGH CASE	8.6%	8.3%	7.7%			
GDP (RWF BN)	3543	6918	26304			

Source: Surbana

3.1 Economic Settings & Outlook

3.1.1 INSIGHTS OF SOCIOECONOMIC ANALYSIS

As an integral guiding component to the visioning exercise, an analysis of the socioeconomic growth for the city of Kigali has been undertaken. This will determine the projected size of the economy and the anticipated growth in population and the employment over the years. All this will guide to understand the requirement of land for various uses within Kigali City up to year 2040.

Three possible growth scenarios have been analyzed so that a comparative view can be established. Key highlights of the conclusion of the socioeconomic study which will be considered in the subsequent physical planning study is discussed below.

3.1.2 ECONOMIC & EMPLOYMENT PROFILE OF RWANDA

Rwanda's recent economic performance has been widely recognized as a (far too infrequent) success story within Sub Saharan Africa, averaging more than 7% annual growth over the last 5 years. The economy remains small at just under \$6 billion in 2011, but a GDP per capita of \$585 places Rwandan's as the second highest income per head within East Africa.

Post 1994 development in Rwanda has been driven by two phases of economic development; the first 5 to 10 years of rebuilding and return to investment in physical and human capital brought rapid growth without much transformation away from an agriculture dependent economy. The second phase has seen a structural shift out towards a now dominant service sector, as well as strong growth in a nonetheless small industrial sector. There has been rising agricultural productivity which has allowed the sector to grow by 4.7% over the last 5 years despite agricultural employment growing by just 1.1%.

Labour has begun a shift to off-farm activities, both causing and as a consequence of growth in the industrial and service sectors. Off-farm employment now totals 1.4 million, or 28.3% of the workforce, compared to 0.44 million a decade ago (11.4%). The service sector has driven this transformation with average growth of 9.8% since 2006, and an increasing share of employment. (Refer to Table 3.1)

3.1.3 PROJECTED ECONOMIC & EMPLOYMENT PROFILE OF RWANDA

Rwanda is projected to continue the strong growth experienced over the last decade, where 7.4% growth was recorded, with growth rate ranging from 7.1% (Low case) to 8.3% (High case) over the next 10 years. Afterwards, growth is projected to stabilise around 6% for base case and 7.7% for enhanced case. Average GDP per capita will increase to RWF 509,205 (approx. US\$ 850) by 2020 from a baseline of RWF 304,519 (US\$ 508). (Refer to Table 3.3)

The key assumptions regarding input variables which would affect the economic growth rate are:

- Capital Stock
- Labour
- Quality of Labour
- Technological Progress

The industrial and service sectors will

continue to eat into agriculture's share of GDP over the coming decades. This structural transformation will have significant implications for employment and urban areas such as Kigali City.

Based on trends, skills, capacity for growth & policies, the highest growth will be in the industrial sector whose average growth is expected to be +10% growth per annum up to 2020. Similarly, the services sector will grow by around 7.5% and the agriculture by 4 - 4.5% (Refer to Table 3.7). The Service sector will continue to expand with the finance, insurance, tourism and ICT sectors plaving a pivotal role while agricultural growth will be driven by productivity rather than employment. The industrial sector currently contributes 16% of national output, with half of this coming from the construction sub-sector which has also been a key catalyst in drawing labour into off-farm jobs.

3.1.4 CURRENT PROFILE OF KIGALI CITY

Currently, data on production and output for Kigali City is not specifically disaggregated in the national accounts. However, GDP is calculated according to an aggregation method of production by sector, and weights for production (Kigali based as a percentage of total) are constructed using capital stock data from the Establishment Census 2011.

Based on the constructed weights and growth estimations, the output of the city of Kigali is approximately RWF 1.266 Trillion (around US\$ 2.1 billion), taking a 41.0% share of national GDP. As per the Establishment Census 2011, 24% of all establishments of Rwanda are within Kigali. The workforce in Kigali City has grown by

4.6% over the last five years and provides employment to 487100 people. The offfarm employment share has seen a growth of 5.9 % per annum from 2005 to 2010. The employment for off-farm in 2010 was 373606 compared to 280253 in 2005.

The current growth scenario for the various employment sectors in Kigali City are as follows:

INDUSTRIAL SECTOR

The industrial sector accounts for 33% of the GDP and has witnessed growth of 9.7% p.a. in the last five years. The employment in the industrial sector has increased from 43764 in 2005 to 69667 in 2010. The construction sub-sector is a major employer. The sector consists of:

- mining and quarrying
- manufacturing
- utilities
- construction

SERVICES SECTOR:

The services sector accounts for 62% of Kigali's GDP compared to 48.5% nationally, and has witnessed growth of 5.1% p.a. in the last five years. The employment in the services sector has increased from 236489 in 2005 to 303939 in 2010. The services sector consists of:

- Whole sale & retail trade
- Transportation storage & ICT
- Accommodation & food storage
- Finance & insurance
- Real estate activities & business services
- Professionals, scientific and technical
- Education & Health
- Other services activities

AGRICULTURAL SECTOR:

The agriculture sector accounts for just 5.5% of Kigali's GDP and includes forestry and fisheries. The sector has seen only slight growth of 0.9% over the last five years.

3.1.5 Key issues and implications

- The mid-term outlook for Rwanda depends on increased investments in core sectors like energy and transport, and the continued growth of construction and service sectors that has been the key driver of recent success.
- As Kigali moves towards a more services led economy - this would lead to an increased need for skilled human capital.
- Kigali will have a healthy industrial sector, which will a major employer. This in-turn will translate into a greater focus on developing the skill base of the labour force through development in the education sector.
- In order to sustain the growth, it is not only important to invest in infrastructure, but a significant effort in building up intellectual & human capital is also required as this would enable a shift towards a knowledge and innovation based economy.

Table 3.4 Main employment activity of workforce, Kigali City, 2010/11



Source: Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

3.1.6 PROJECTED ECONOMIC GROWTH & EMPLOYMENT BY SECTORAL COMPOSITION

- Kigali's GDP ranges from a minimum of RWF 4.7 trillion to a maximum of RWF 5.7 trillion in 2025, and a minimum of RWF 12.29 trillion and a maximum of RWF 21.28 trillion in 2040.
- The total workforce growth of 5.6% p.a will be witnessed for the city of Kigali over the next decade.
- Agricultural growth will be low due to decrease in employment, but agricultural productivity will rise due to improved skills.
- Industry and services will lead growth as value addition and skills development progress.

The projected growth scenario for the various employment sectors in Kigali City are as follows:

INDUSTRIAL SECTOR:

It is expected that Kigali's share of industrial development will at first be significant, due to the high level of existing and planned infrastructure relative to other areas of the country. The industrial sector within Kigali is expected to grow strongly over the next decade; the construction industry will

Table 3.5 Projected Economic Scenarios for Kigali City, 2011-2040



Source: Surbana

Table 3.6 Sector Composition of GDP of Kigali City 2011-2040



Source: National Institute of Statistics, GDP Estimates 2010/11, 2005 prices

PROJECTED EMPLOYMENT ('000S) SCENARIO					
	2011	2025	2040		
AGRICULTURE					
LOW	116	108	75		
MEDIUM	117	120	83		
нідн	116	92	42		
INDUSTRY					
LOW	107	287	505		
MEDIUM	108	317	560		
нідн	109	308	670		
SERVICES					
LOW	296	724	1051		
MEDIUM	297	758	1320		
нідн	300	960	1624		
TOTAL EMPLOYMENT					
LOW	524	1119	1631		
MEDIUM	523	1196	1963		
нідн	526	1360	2336		

Table 3.7 Projected Employment ('000s) Scenario by Sector, Kigali City 2011-2040

Source: Surbana

Table 3.8 Average Income and Distribution, Kigali City, 2011-2040

RWANDA PROJECTED ECONOMIC SCENARIOS					
	2011	2020	2040		
Average Income (RWF)	658,097	1,116,127	2,642,706		
<rwf 100к<="" td=""><td>0.4%</td><td>0.2%</td><td>0.0%</td></rwf>	0.4%	0.2%	0.0%		
RWF 100ĸ - 200ĸ	2.9%	1.1%	0.1%		
RWF 200ĸ - 400ĸ	13.2%	6.1%	1.2%		
RWF 400ĸ - 600ĸ	13.7%	15.1%	16.2%		
RWF 600ĸ +	69.8%	77.6%	82.5%		
Average HH Income (RWF)	3,112,198	4,975,890	10,190,666		

Source: Surbana

continue to boom in Kigali although.

rising costs of industrial inputs could taper growth. Availability of land will remains a key issue to sustain this growth, and the Special Economic Zone will be key in this regard. By 2020, 37% of Kigali's output will come from the industrial sector. Kigalibased industries will contribute around 75% of all industrial output, at RWF 1.1 billion. After 2020, growth in the sector will begin strong as productivity levels rise, and will then settle at around 8% growth per annum.

The industrial sector will lead employment growth, as in output, with growth of above 10% per annum for the next decade. There after, growth in industrial employment will decline towards 5% per annum by 2030, with a long run growth rate of between 3 and 4% per annum.

SERVICES SECTOR:

The service sector, set to also grow strongly in terms of output, will grow at a slower rate than industry in terms of employment but will benefit from significant improvements in productivity. The sector will grow between 7.5 and 9.5% until 2020. Thereafter, the sector will experience strong growth as skill level improvements begin to be realised. This will furhter increase the productivity. This will be followed by a long term trend of around 8% growth in the services sector.

The employment growth in service sector employment will average between 5 and 8% up until 2020, with a long run growth rate of around 7%. This compares to overall service sector output growth of around 8%. Growth in the service sector will be positively affected by increasing skill levels and the continued expansion of the finance and insurance market, which will still be predominantly based within Kigali.

AGRICULTURAL SECTOR:

Kigali's contribution to agriculture is expected to decline significantly after 2015, as the city further urbanises, and will further decline as a result of diminishing agricultural land after 2020. Productivity levels in agriculture will rise as specialisation and skills improve, however the output will decrease from 6% to just 1% by 2040.

Agricultural employment will also decline by 2.5% p/a although after 2015. The overall share of off-farm employment in Kigali will increase from 77% in 2010 to 91% by 2020 and 98% by 2040. In 2020, Kigali will contribute 60% of all off-farm employment compared to 27% currently. This will eventually decline to around 47% by 2040.

3.1.7 INCOME ANALYSIS

The average income of a citizen in Kigali will be driven by changes in overall national and provincial growth. However changes in the structure of Kigali's economy will be a key factor in driving incomes upwards, such as shift towards off-farm jobs.

Table 3.8 indicates the average income level is expected to reach RWF 1.1 million by 2020 (approx. \$ 1850), and will increase steadily to around RWF 2.6 million (approx. \$ 4630) by 2040. This compares to national GDP per capita of RWF 510000 in 2020 and RWF 1.3 million in 2040. The share of those earning below RWF 400,000 (approx \$660) threshold is expected to decrease steady with 88% earning above the RWF 400,000 threshold by 2020 and 99% by 2040.

HOUSE HOLD INCOME

Average household income takes into account the changing demographic traits of Kigali's population, as well as the household sizes. At the same time the total workforce as a percentage of the total population will increases as the dependency ratio decreases, which is also reflected in the projected household incomes. It is projected that the household income will increase form RWF 3.1 million (approx. \$5100) in 2011 to RWF 5.0 million (approx. \$8250) by 2020, and RWF 10.2 million (approx. \$16,800) by 2040.

3.2 Socio- Demographic Scenario & Outlook

3.2.1 Current Socio-Demographic Profile

URBAN & RURAL POPULATION

The total population of Rwanda in 2010/2011 was estimated to be 10.76 million by the household survey, known as EICV3, compared to 9.49 million in 2005/6. This represents an annual population growth averaging 2.8% growth per annum. Majority of the population in Rwanda today live in rural areas, with only 14.8% living in urban areas. A large portion of the people living in urban areas resides in Kigali. By province Kigali City represents 10% of the national population, but inevitably has the largest share of urban to rural population. Kigali City today has an estimated population of 1,06 million¹. Kigali City is also the most urbanized of Rwanda's five administrative provinces. According to the EICV (2011) survey around 84% of the population of Kigali City is categorized as urban dwellers, with only 16% living in rural residential areas. Conversely, the rest of

Rwanda has 85% of its population in rural residential areas and only 15% urban.

The City comprises three administrative districts: Gasabo, Kicukiro and Nyarugenge. Of these, Gasabo has the largest share of the population of Kigali City, at 44 percent. The remaining 56 percent of the population is shared equally between Kicukiro and Nyarugenge.

URBANIZATION RATE

The urban lure makes Kigali City the fastest growing province in the country. As the nation's capital and therefore host to the most vibrant commercial center in the country, a comparatively high rate of urbanization is visible in Kigali. Its population growth rate is 6.2% compared to 2.8% for the rest of the country.²

SOCIO DEMOGRAPHIC FINDINGS

2 SPHD, 2006

Rwanda currently has the highest population density in Africa at 370 people per square kilometers. Currently, life expectancy at birth is 59.5 for women and 56.5 for men. Likewise, the fertility rate as compared to 2005 of 6.1 has seen a gradual decline and is estimated in Kigali to be 4.6 in 2010. The desired fertility rate currently stands at 3.3. Currently, 57% percent of the population in Kigali is between the age group of 15-65 years of age, while 40% percent of the population is under the age of 15 years of age. This suggests that Kigali has a young population with potential for future economic growth supported by the healthy supply of workforce. With the improvement of standard of living, increase in income and health awareness and improvement of medical treatments life expectancy in Kigali is gradually increasing and is currently 56.5 for males and 59.5 for females.

Currently Kigali is seeing high level of migration. Majority of this is inward migration as a result of new economic opportunities created in Kigali. Increase in international migration of skilled talent is also seen to increase as Kigali's economic growth and regional influence increases, and the Rawandese diaspora return to their homeland.

Literacy rate in Rwanda was 74.95% (World Bank, 2010). For the general population of 15 years and above, the literacy levels are relatively higher for Kigali City at almost 87%. The government's compulsory primary education scheme has been a key driver for this increase in the literacy. Within Kigali, attendance at primary level is currently 94%, however secondary level education is only 41% and tertiary education is currently still low at 8.6%.

HOUSEHOLD SIZE & INCOME

The average household size is an important statistical unit which helps in estimating the number of households which translates to housing needed for the population. The average household size in Kigali today is around 4.7 persons (2011) as compared to 4.8 (2002), which translates to around 240,000 households.

URBAN PATTERN

The 2005 administrative reforms were intended to bring people away from isolated habitats as a means to improve their access to public services, as well

1 EICV3, 2011



Table 3.9 Distribution of Rwanda Population by Province

Source: EICV3 2010/2011

Table 3.10 Distribution of Kigali City Population



Source: EICV3 2010/2011

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as move them into modern residential habitats. Indeed, planned resettlement has, to a large extent, achieved part of the objectives of the reform. According to the existing land use, 84.4% of the city live in urban informal (unplanned housing) or "slum" areas. Only 3.4% of households in Kigali City live in modern planned areas. Nationally, less than one percent (0.6%) of households live in such planned habitats. 10.6% of households in Kigali still live in isolated rural housing habitats.

3.2.2 Projected Growth & Composition

POPULATION SCENARIOS

The established trend of Kigali City of becoming an ever more highly urbanized region will continue. Growth projections are created for three scenarios for the future population development, High Growth, Medium Growth, and Low Growth Scenario taking EICV3 2011 as the base year. The low case scenario assumes a growth rate of 4.1% at 2025 which reduces to 1.8% by 2040, while the medium case assumes a growth rate of 5% until 2025 and 2.5%. hence. Similarly, the high case scenario

	, 					
NUMBER OF HOUSEHOLDS						
	нн	Рор.	SIZE			
Nyarugenge	60262	282,730	4.7			
GASABO	99447	476,250	4.8			
KICUKIRO	64056	301,486	4.7			
Kigali City	223765	1060466	4.7			

Table 3.11 Kigali Current Household Size

Source: DHS 2010



Table 3.13 Kigali City Projected Annual Growth Rate



Table 3.14 Kigali City Projected Net Migration



Table 3.15 Household Size Projections (2010 - 2040)

HOUSEHOLD SIZE & (HOUSEHOLDS IN MIL)	2010	2015	2020	2025	2030	2035	2040
HIGH	0.25	4.35 (.35 mil)	4.25 (.53 mil)	4.15 (.65 mil)	4.05 (.91 MIL)	3.95 (1.2 MIL)	3.85 (1.3 MIL)
MEDIUM		4.35 (.34 mil)	4.05 (.51 MIL)	4.05 (.60 mil)	4.05 (.77 mil)	3.85 (1.0 mil)	3.55 (1.2 MIL)
LOW		4.35 (.33 mil)	3.85 (.52 mil)	3.85 (.59 mil)	3.55 (.79 mil)	3.35 (.96 mil)	3.35 (1.0 міс)

assumes the growth rate to be 5.8% till 2025 and 2.5% thereafter. Much of this growth is potentially driven by two principal factors. The high assumptions for fertility rates are expected to remain between the current rate of 3.5 and 3.0 in 2040. The second factor is that of immigration into the City.

As agricultural employment within Kigali declines, off farm employment is projected to represent 97.5% of the employment. Similarly by 2040, 95% of the population is projected to live in urban areas. In the low case scenario the population of Kigali is projected to be 2.3 million by 2025 & 3.5 million by 2040. In the medium case scenario, Kigali's population in 2025 will be 2.5 million and will grow to become 4.3 million by 2040. Similarly, for the high case scenario, the population is projected to be 2.9 million by 2025 and 5 million by 2040.

SOCIO-DEMOGRAPHIC PROJECTIONS

As the focus of employment further shifts from agriculture to off-farm employment, migration into Kigali will further increase in all scenarios and will be a significant factor for population growth. The low case scenario assumes migration to remain constant up till 2025 and decrease there on to become half the current level by 2040. The medium case scenario assumes migration doubles by 2025 and thereon

 Table 3.16
 Fertility Rate Projections (2010 - 2040)

decreases to its current level by 2040. However, the high case assumes migration to increase by 250% to a peak in 2025 and then decreases back to current levels by 2040. It is assumed that international migration to be 24% of the total migration which will be focused in Kigali.

In regards to net attendance in education in Kigali, primary education will increase to 99.5% by 2040, while secondary education will increase to 65% by 2020 and 85% by 2040. In the tertiary education, the net attendances will be 18% by 2025 and hereafter to 31% by 2040. This increase in the literacy will mean more skilled labor to support the higher economic growth projected in the future. Higher and more educated women, will mean more participation of women in the employment sector. This will mean child birth at a later age implying reduction of the fertility rate. Hence, the fertility rate within Kigali will decline in all three scenarios as shown in Table 3.16. With educated female population, and improved access to health care and management of child illness, child mortality is expected to decline further. It is also projected that life expectancy increases as per capita income increases due to increased quality of life.

able 5.10 Fertility rate Projections (2010-2040)							
	2010	2015	2020	2025	2030	2035	2040
HIGH		3.5	3.4	3.3	3.2	3.1	3
MEDIUM	3.5	3.3	3	3	3	2.8	2.5
LOW	-	3.3	3	3	2.7	2.5	2

Table 3.12 Kigali City Projected Population

HOUSEHOLD SIZE

The projected decrease in fertility and increase in literacy of both the sexes, and more women in the workforce, means a decrease in the household size in all three scenarios. From the projected household size for all three scenarios, one can project the number of houses which will be required in Kigali in the 2025 and 2040 respectively as seen in Table 3.15.

KEY ISSUES AND IMPLICATIONS

Over the last decade, Kigali has seen a population growth of 6.2 %. as well as significant economic growth. The national GDP has grown at approximately 8% yearly. As the population further increases supported by economic growth & higher literacy and more skilled workforce, Kigali will remain a strong magnet attracting more inward migration for all forms of job seekers. This will lead to significantly more demand on the land for housing and employment centers adding more pressure on its natural assets. Given Kigali's unique geography, the challenge will be to provide equitable quality of life and opportunity while still retaining its natural environment.

(For a detailed socio-demographic report please refer Appendix 1)

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

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URBAN SUSTAINABILITY FRAMEWORK & DEVELOPMENT VISION

4.1 Urban Sustainability Framework

Based on the specific and pressing issues in the City of Kigali, the Urban Sustainability Framework is established to address these aspects by providing guiding principles for the subsequent planning processes that will ensure the long term sustainability of Kigali.

In the context of Kigali, five specific issues are identified that will form the basis for Urban Sustainability Framework. These issues are:

ENVIRONMENTAL ISSUES

• Rapid urbanization and encroachment of nature areas

Increasing pressure on resources and Carbon footprint

Social Issues

• Large disparity in living conditions between "Rich" & "Poor"

ECONOMIC ISSUES

- Pressing need for expanding the skilled workforce
- Need for more employment opportunities to cater to the increasing population.
- Need for attracting and directing investments.

The key strategies and recommendations to tackle the above mentioned issues as well as the challenges are highlighted in Table 4.1.

Table 4.1 Urban Sustainability Framework for City of Kigali

COMPONENTS	Key Issues	DIRECTION	CHALLENGES	RECOMMENDATION
ENVIRONMENT Nature, Resources and Carbon Footprint	 NATURE AREA Urban areas prone to land slide Illegal developments on steep slopes Deforestation Encroachment of wetlands 	 Clearance of development in Steep Slopes and Wetlands Restoration of steep slopes & wetlands Acquire land for relocation of developments in steep slopes and wetlands 	 Cost of Land Acquisition & relocation Cost for programming and implementation a restitution of nature areas 	 Conserve all slopes above 40% Conserve all wetlands Prepare Redevelopment schemes to relocate people from steep slopes & wetlands Prepare strategies for rehabilitation and for management of slopes, forests and wetlands.
	 RESOURCES & CARBON FOOT- PRINT Sprawling low rise development Expanding urban areas Need for extended infrastructure / transportation facilities Increasing carbon footprint Increasing urban temperature 	Compact city development	 Affordability of intensified and high- rise development Cost for high capacity transport infrastructure. 	 Limit urbanization boundaries Identify potential high density mixed use zones Reduce sprawling development and hence, reduce infrastructure / transportation cost. Explore possibilities for further City greening to counter increase in carbon footprint.
SOCIAL LIVING CONDITIONS.	Large disparity in quality of living environment between the rich and the commoner (majority)	 Provide good quality affordable housing for all 	Need for large funding resources	 Create various public housing/improvement schemes Ensure improved living quality for commoners and minimize the gap in terms of living quality.
ECONOMY Employment	 Lack of well-serviced attractive areas for investment Need for more employment opportunities for the increased natural and migrant population. 	 Create dedicated areas for businesses and regional commercial activities Job creation 	 Need to make strategic land acquisitions for a well-monitored commercial development. Types of jobs & investments that will come to Kigali in the long run are not definite. 	 Anticipate various investment possibilities Safeguard land for economic expansion at key areas (CBD /commercial centre, industrial areas, tourism spots)



Fig.4.1 Urban Sustainability Framework for City of Kigali

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

4.2 Development vision for Kigali City & District Development Visions

4.2.1 DEVELOPMENT VISION FOR KIGALI

"The Centre of Urban Excellence"

All the former studies such as Vision 2020,

the National Land Use Master Plan and Kigali Conceptual Master Plan have identified the significance of Kigali as a Regional as well as Continental Economic Hub.

With the strong forward looking government and the promising visionary leadership, Kigali is well capable of setting a unique identity in the world arena. Kigali is also rich in enchanting and pristine natural resources and comprises of enterprising young society and a strong work culture. With such strengths and as one of Africa's fastest urbanizing economies, Kigali can establish itself as a remarkable example of Urban Excellence. Hence, strengthening this ideology further, Kigali is envisioned to be the Centre of Urban Excellence in Africa, a model city and a shining example for other emerging cities in the continent.

Several cities with humble beginnings such as Curitiba, Vancouver and Singapore have used urban planning & management as a tool to achieve economic & social progress. These Cities today are viewed as successful examples of Urban Excellence for different urban sectors.

To achieve this Vision, Kigali needs to focus on achieving the global standards in the following five key urban sectors.

CITY OF VIBRANT ECONOMY

To achieve urban excellence, it is of utmost importance to create a unique & vibrant city that can be identified by its world class business environment, distinctive regional destinations & exciting recreational opportunities. The City shall aim at becoming one of such places.



CITY OF QUALITY AFFORDABLE HOMES

Over 80% of Kigali's population live in unplanned housing. While the City needs to cater to the large demands of the massive population in this income bracket, it is an opportunity for the City to develop strategic model solutions for providing affordable housing for its people, that can also be emulated in future cities of comparable context.



CITY OF ENCHANTING NATURE & BIO-DIVERSITY

Kigali City is blessed with natural landscape. The rolling hills, vast wetlands and the surrounding lakes are some of the pristine natural resources that makes the City liveable. It shall be aimed to maintain and enhance these natural assets to create an excellent balance between nature and living.



CITY OF GREEN TRANSPORT

Transport in Kigali is still in rudimentary stages and there is a great need for enhanced mobility. Due to lower income levels, the private vehicle ownership is still in lower limits. However with the increasing low rise sprawl, there will soon be huge traffic impacts. Affordable and sustainable public transport system is another urban sector that the City of Kigali can champion.



CITY OF ENDEARING CHARACTER AND UNIQUE LOCAL IDENTITY

The interaction of landscape, built form, history, people and their local culture gives a place a distinct identity. The continuance of the local character gives the people a sense of belonging while enhancing community life. This distinctness is attractive to tourists as well as investors, providing the city a competitive edge by virtue of its unique identity.



CITY OF SUSTAINABLE RESOURCE MANAGEMENT

Although the consumption of energy and water usage are quite low in Kigali; the City faces extreme inadequacies in terms of making provisions for these infrastructure. The City could target to adopt excellent sustainable resource management strategies to manage the local resources and to contribute in global sustainability.



4.2.2 DISTRICT DEVELOPMENT VISIONS

Kigali comprises of 3 administrative districts with its own unique strengths and potentials.

At the City scale, Kigali is envisioned to become a Centre of Urban Excellence, these 3 different Districts can optimize on its assets and contribute to the City's vision in different ways by developing sub-sets of district development visions. This will enhance the identity of each district in a complimentary manner.

3 distinctive roles have been assigned to the 3 districts of Kigali as illustrated below.



"The Green Financial Hub and "Vibrant Growth Centre of kgiati"

Gasabo :

"Diverse Employment Hub and Cultural Heartland of Kigali"

Kicukiro :

"Knowledge Hub and Green Galeway of Kigali"

4.3 Benchmarking Urban Excellence

4.3.1 BENCHMARKING CRITERIA

To achieve the vision of "Urban Excellence", some of the leading global Cities have been studied and analyzed based on selected criteria. The criteria for selecting the benchmark cities are as below:

- Comparable size of the City
- Comparable aspired Economy
- Transit Oriented City with compact development
- Leading global example in provision of excellent affordable housing
- Leading global example in provision of urban infrastructure
- Green and sustainable city

4.3.2 BENCHMARKED CITIES

Based on the above mentioned criteria, 3 cities; Singapore, Curitiba and Vancouver have been selected for benchmarking. While Singapore is quite comparable in terms of its scale and specifically the urban solutions it has offered to address the affordable housing and quality public transportation issues; Curitiba is more comparable to the City of Kigali in terms of its aspired economic goals and for its excellent transit oriented development. The third city selected for benchmarking is Vancouver, which despite being a North American City, has successfully set an international example for being green and providing most liveable environment in the City. The City's statistics for Singapore, Curitiba and Vancouver are highlighted in Table 4.2.



Table 4.2 City Statistics for Singapore, Curitiba and Vancouver

SINGAPORE	CURITIBA	VANCOUVER	
CITY IN A GARDEN	GREEN CAPITAL	GREENEST CITY 2020	
 City: 710 km2 Population:5.1 mil Density: 7315 p/km2 GDP /capita - \$ 50,700 Household size: 3.5 Households: 1.14 mil Jobs: 3.6 mil 	 CITY: 430.9 km2 Population: 1.9mil Density: 4300 p/km2 GDP /capita - \$ 10796 Household size: 3.8 Households: - 0.5 mil Jobs: 0.71 mil 	 CITY: 2800 km2 Population: 2.3 mil Density: 736 p/km2 GDP /capita - \$ 37600 Household size: 2.58 Households: 0.85 mil Jobs: 1.1 million 	• () • F • [] • () • H • H • J

Kigali



KIGALI CENTRE OF URBAN EXCELLENCE 2040

CITY: 731 km2 Population: 5 mil Density: 6850 p/km2 GDP /capita - \$ 6900 Household size: 3.8 Households: 1.3 mil Jobs: 2.4 million EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

4.3.3 CITY COMPARISON

Different urban aspects such as Green Space, Affordable Housing, Transit mode, Sustainability solutions and the distinct city features, etc are compared across the bench marked cities for the urban analysis.

Certain measurable targets are recommended for the City of Kigali based on the comparative urban analysis. The general recommendation from the benchmark study shall be further elaborated in the Vision Framework setting comprehensive sector-wise goals that are developed based on the existing site conditions.

SINGAPORE





Table 4.3 Comparison of Key Urban Sectors for Singapore, Curitiba and Vancouver

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CURITIBA





VANCOUVER



	CITY IN A GARDEN	GREEN CAPITAL	GREENEST CITY 2020	(
GREEN SPACE	• 7.5 m2 per capita	• 51 m2 per capita	11m2 per capitaLive within 5 min walk from a park	•
HOUSING	 Public housing for 80% of population. Housing Estates planned as integrated townships Efficient Estate management by town Councils 	 75 % of population live on 41 % of land Transit axes (7% of land) houses 20 % of the population 	 35% -Single Detached, 25% Ground, 40% - Apts Social Housing : 50,000 DU (i.e. 16% of rental housing) 	•
TRANSIT MODE (MODAL SHARE)	 Integrated Bus & Metro 59:41; target 70:30 (public: private) 	 Dedicated BRT +Bus 45:28:27 (public: private: walk+cycle) 	 Light rapid transit + Electric Trolley 16:74:8 (pub: private :walk+cycle) 	•
SUSTAINABILITY SOLUTIONS	 67% of land is water catchment Innovative water supply solutions 60% waste recycling Green network 	 Green Exchange: waste for food/transit 70% recycling rate Parks to control floods Treat 98% of wastewater 	 Reduce solid waste by 40% Reduce green house gases by 33% Reduce water consumption by 30% 	•
CITY FEATURES	Marina BayTheme ParkShopping StreetChangi Airport	 City Centre Botanical Garden BRT Line Iconic Museum 	 Waterfront Chinese Garden Park Ice Hockey 	• • • •

Kigali





CENTRE OF URBAN EXCELLENCE- 2040

4 m2 per capita in urban areas (Overall 90m2)

Slum free city 90% ownership Living Space/Person Urban (20 m2)

BRT/MRT 70:15:15(public : walk+cycle : private)

40% Waste Recycle Green Energy Farm

Financial Hub Leisure and Entertainment Hub Mice and Conference Centre Adventure Theme Park Sports City Wetland Bio-Diversity Park

4.4 Vision Framework

To achieve the holistic vision of making Kigali the "Centre of Urban Excellence", sectoral goals which address the key issues have been set. These sectoral goals are elaborated recommending the key strategies that the City will need to adopt and the targets that are required to be achieved to realize the vision.







4.4.1 CITY OF VIBRANT ECONOMY, CHARACTER AND IDENTITY

Table 4.5 Goals and Strategies for City of Vibrant Economy

STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	
CREATE VIBRANT BUSINESS ENVIRONMENT STRENGTHEN ECONOMY & PROVIDE FOR REGIONAL AND LOCAL EMPLOYMENT OPPORTUNITIES TOURISM GATEWAY OF CENTRAL AFRICA	 ~1 mil sq m of office related commercial floor space ~0.03 mil sq m of retail related commercial floor spacE ~0.76 mil sq m of industrial floor space 1106 hotel rooms 560000 jobs 	 Making a modern Regional Financial Hub in Africa Providing adequate working spaces for 1.62 mil in service sector jobs Providing adequate working spaces for 0.67 mil in industrial sector Promote high-value added agriculture and agro-based industries 	•
DEVELOP EXCITING REGIONAL AND RECREATIONAL DESTINATIONS		 Develop at least 1 regional and recreational destination in each district 	•

4.4.2 CITY OF QUALITY AFFORDABLE HOMES

 Table 4.4
 Goals and Strategies for City of Affordable Homes

STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	
PROVIDE QUALITY HOUSING & PUBLIC FACILITIES	 83.5% population living in unplanned housing ~45% home ownership (including the property owned in unplanned areas) <1% affordable housing 1.9% Public Facilities, unplanned areas are not adequately serviced by educational, health and civic facilities. 	 Slum Free City - City free of illegal / unplanned areas 90% home ownership 60% affordable housing Easy access to quality, affordable facilities within all residential areas 	•
PROVIDE ACCESSIBLE AND QUALITY RECREATION SPACES	 Limited recreational open space Open Spaces are not well distributed Existing Open Space < 1 sqm / person 	 4 sqm Public Recreation open space / Capita 1 local open space within 400 m walking distance 99 sqm Total Open Space including nature areas 	•

INTERNATIONAL STANDARDS

Singapore-10.6 mil m2 commercial space serving 5 mil populations, with 29 000 hotel rooms. Hong Kong-21 mil m2 commercial space serving 7mil populations, with 60 104 hotel rooms.

Specific to the site context

INTERNATIONAL STANDARDS

Specific to the City context

Singapore – 8 sq.m/ person (target) African cities index average - 74 sq.m/ person Asian cities index average - 39 sq.m/ person Latin American cities index average - 255 sqm/ person Curitiba – 54 sqm/ person Addis Ababa - 37 sqm / person **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

4.4.3 CITY OF ENCHANTING NATURE AND BIODIVERSITY

Table 4.6	Goals and Strategies	for City of	Enchanting	Nature and	Biodiversity
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STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	INTERNATIONAL STANDARDS
Preserve topography & slopes	 35% Land falls within the Steep Slope Category 14% Steep Slopes are illegally built upon 	 No development on steep slope (conditional low intensity developments) Relocation of unplanned communities in steep slopes and full restoration of slopes above 40% 	Specific to site context
PREVENT ALL SOIL EROSION	Erosion & landslides in certain areas within city	 Mandatory soil stabilization of all slopes (both public areas & private developments) 	Specific to site context
Manage all Water bodies & watershed	 Pollution & degradation of streams, rivers & ground water Localized flooding (In Nyabugogo & Masaka) 	 A citywide Watershed Management Plan Flood free city for a 50 years of flood return period 100% conservation of all water bodies 20 m mandatory buffer for all water bodies (Organic Law) 	Specific to site context
CONSERVE AND MANAGE ALL WETLANDS	 14% of City occupied by wetlands 5% of wetlands are encroached Degradation of wetland due to agriculture, sewage and garbage dumping and other urban developments. 	 A citywide Wetland Management Plan No dumping of untreated sewage or waste Zero net-loss of existing wetlands Restoration of wetlands encroached for urban uses 20 m mandatory buffer for all wetlands (Organic Law) 	Specific to site context
CONSERVE AND ENHANCE FOREST AND NATURAL AREAS	 9.9% of Forests and Natural Areas (724\1.5HA) Deforestation to accommodate urban, energy and farming uses 	 Zero net loss of existing forests Afforestation in slopes > 60% Reforestation to restore former forests 	Specific to site context
Manage Agriculture Land	Agriculture in wetlands, protected forest & steep slope areas	 Creation of innovative urban agriculture for slopes > 20% Comprehensive management plan for agriculture and agro-forestry along steep slopes Plan for management of agricultural practises in wetland areas 	Specific to site context









4.4.4 CITY OF GREEN TRANSPORT

Table 4.7 Goals and Strategies for City of Green Transport

STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	INTERNATIONAL STANDARDS
PROVIDE EFFICIENT PUBLIC TRANSPORT NETWORK	Public : Private Transport ratio of 80:20	 Public : Private Transport ratio of 70:30 with excellent quality of public transportation 10% non-motorized Green Trips 	 Hong Kong – 90% public transport Curitiba 61:39 (Public : Private) Bogota 75:25 (Public : Private) Singapore 59:41 target 70:30 (Public : Private) London 57:43 (Public : Private) Capetown 67:33 (Public : Private)
_	 No Expressway <20% of the road are paved 	 Length of expressway = 30 km / mil population 100% of National Roads and Class District roads to be paved and designed to international standards 	 Length of Expressway in Singapore = 33 km/mil pop Paved Roads designed to International Standards in Singapore = 100% Paved Roads designed to International Standards in Hong Kong = 100% Paved Roads designed to International Standards in Bogota = 77%
ENHANCE ROAD CONNECTIVITY WITHIN AND OUTSIDE THE CITY	Not measured	1 hour connectivity to international transport terminal (e.g. airport, international rail station)	 Singapore = 40 mins by train To airport= 20 mins by car Tokyo = 36 mins by train from major rail station in city Curitiba = 30 min to 45min by Citybus Hong Kong = 24 min by Airport express
		1 hour connectivity to major employment node	 Singapore = 36 mins South Africa = 35 mins San Francisco = 58 Curitiba = 67 mins Capetown = 32 mins
DEVELOP A PEDESTRIAN FRIENDLY ROAD NETWORK	Limited pedestrian facilities	 100% provision of pedestrian walkway along development side of the road 20 km / million Green Network 	Singapore – Park Connector 30 km / million



4.4.5 CITY OF ENCHANTING CHARACTER AND UNIQUE LOCAL IDENTITY

 Table 4.8
 Goals and Strategies for City of Enchanting Character and Unique Local Identity

STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	INTERNATIONAL STANDARDS
LOCAL IDENTITY DEVELOPMENT FOR KIGALI	 Several Existing Museum e.g Genocide Memorial Museum, Museum of Natural History etc. and several Genocide Memorial Sites Some areas and buildings in Nyarugenge have be identified to be conserved in the Nyarugege Master plan Urban Design for Nyarugenge is present but city lacks a comprehensive Urban Design Strategy Lack of Heritage Strategy 	 Develop 3 special precinct or heritage precinct in Kigali Preservation of all historic and culturally important sites 	Specific to the site context
TOURISM STRATEGY FOR KIGALI	 Sustainable Tourism Development Masterplan for Rwanda 1106 Hotel Rooms 	 Double tourist arrival in Kigali by 2025 (as per the Sustainable Tourism Development Masterplan for Rwanda) Develop at least 1 regional tourism destination in each district 	Specific to the site context



4.4.6 CITY OF SUSTAINABLE RESOURCE MANAGEMENT

	Table 4.9	Goals and Strategies for Cit	ty of Sustainable Resource	Management
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STRATEGIES	EXISTING CONDITIONS & ISSUES	TARGETS & KPIS	INTERNATIONAL STANDARDS
IMPROVE WATER SUPPLY NETWORK IN CITY ENSUR- ING MINIMUM LEAKAGE AND WATER LOSS. Adopt sustainable rainwater harvesting	 Network coverage: 40% of Kigali City area Piped water supply to household: CBD only Stand pipe service radius: 280m Available supply: 45 lcpd Rainwater harvesting: Sporadic Water saving devices: Uncommon Water leakage loss: 40% 	 20% lower water usage than world average Network coverage: 75% Piped water supply to household: All urban development Stand pipe service radius: 250m (2025) Available supply: 80 lpcd(2025) & 120 lpcd (Yr X) Rainwater harvesting: Systematically implemented for all new urban developments of 0.4 ha and above Water saving devices: Systematically installed for all new urban developments of 0.4 ha and above Water saving devices: Systematically installed for all new urban developments of 0.4 ha and above Water leakage loss: 30% (2025) & 15% (Yr X) 	 Piped water supply in Singapore: 100%, Available water supply in Singapore: 155 lpcd, Melbourne: 142 lpcd, Vancouver: 542 lpcd, London: 150 lpcd, African Index Average – 187 lpcd Water leakage loss in Singapore: 5%, Johannesburg: 12.5 %, Vancouver: 4.2 %, London: 32 %
PROVIDE SANITATION AND SEWERAGE COVERAGE FOR THE ENTIRE CITY	 On-site STP for very few developments Sewerage Coverage: Nil Rural sanitation: pit latrines & open defecation 	 Temporary on-site STP for all new urban developments of 0.4 ha and above (2025); Centralised STP for each sector (Yr X) Sewerage Coverage: 20% (2025) & 75% (Yr X) Rural sanitation: Ecosan system or septic tanks 	Sewerage coverage in Singapore: 100%
DEVELOP EFFICIENT FLOOD CONTROL SYSTEM AND PROVIDE DRAINAGE WITH PROPER MANAGEMENT OF STORM WATER	 Combined storm water and wastewater flow in many areas Open storm drain characterized by channeling and concentrating Flooding and erosion problem at the low-lying and steep areas 	 Separate wastewater sewerage and storm water drainage: 20% (2025) & 75% (Yr X) Use of swales and constructed wetland to slow down storm water runoff in all new urban developments of 0.4 ha and above Proper slope protection for all new developments 	Specific to the site context
Ensure Solid waste collection and management	 Recycling rate: informal Illegal dumping & open burning: 40% 	 Recycling rate: 15% (2025) & 50% (Yr X) Illegal dumping & open burning: 25% (2025) & 0% (Yr X) 	 African Cities index average: 1.12 kg/ person/day; Singapore: 0.89 kg/ person/ day, London: 1.45kg/d, Melbourne : 0.97 kg/d, Johannesburg: 1.2kg/d
Ensure sustained lower energy usage compared to world average		 20% lower energy usage than world average 20% alternative energy source in the city 	Specific to the site context









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5 BROAD LAND REQUIREMENTS

5.1 Introduction

As population in future grows and urbanization accelerates there will be more development pressure on the existing land in Kigali. The urban area will expand into the current peri-urban and rural areas to accommodate this growth. This growth should be checked and controlled. To achieve the vision for Kigali, the concept plan proposes the environmentally sensitive areas like the forest areas, wetlands, water bodies, and steep slopes be respected and protected from future urbanization, while the urbanized area is to be maintained at less than 35% of the land area till Year X.

Planning standards are used to obtain the broad land use requirements to meet the projected population and economic growth while maintain the environment. The planning standards set by the various government agencies in Rwanda, previous master plans like the National Land Use Development Plan, KCMP and the Nyarugenge Detailed Physical Plan were studied, and international planning standards and norms of Singapore and South Africa were analyzed in preparation of the planning standards for Kigali. Planning standards and broad land requirements are established to respond to the needs of the projected population for Year X.

5.2 Hierarchy of Planning Area:

The Concept Plan organized Kigali into a hierarchy of planning areas, which will guide the distribution of employment spaces, parks, and other public facilities within the city and with setting up the requirements for the broad land use. The hierarchy of these areas is based on the population size. Based on detailed study of existing urban character and administrative setup and previous master plans and the future projected population, the proposed urban hierarchy for Kigali City and the relation between the city, town, neighborhood is explained in Table 5.2. Based on an average of 150000-200000 population, Kigali needs to be organized into an average of 20-25 townships to accommodate upto 5 million in the future.

5.3 Kigali Broad Land Requirements

5.3.1 BROAD LAND REQUIREMENTS FOR HOUSING

Kigali currently has a population of 1.3 million. Currently 78% of the city lives in unplanned areas having a density of around 25000 p/km². There are also large areas with low density single family housing which have a density of around 3000 p/km². The newer upcoming developments are having a density 8000 p/km².

As urbanized area is limited to 35% in Kigali, land for housing is very limited. However the population for the city in Year X is projected to be 5 million. Higher density living needs to be adopted if the city is to provide quality living space for its residents. Affordable housing is also an urgent issue. The current low density areas will require to be densified. The average urban density in Kigali is proposed to be 20000 p/km². Broad land use for housing in Kigali is calculated as per the housing densities.

The three densities categorized for Kigali are:

- High Density Housing
- Medium Density Housing
- Low Density Housing

Table 5.1 Proposed Hierarchy of Planning Areas in Kigali





HOUSING TYPE	House Size (in sqm)	GROSS PLOT RATIO	HOUSING SHARE	POPULATION	DWELLING UNITS	Area (sqkm)	DUS PER HA
LOW DENSITY	250	0.5	15%	750000	194,805	49	40
MEDIUM DENSITY	90	1.4	50%	2500000	649,351	42	160
HIGH DENSITY	90	2	35%	1750000	454,545	20	200
TOTAL			100%	5000000	1,298,701	111	

HIGH DENSITY HOUSING:

High density for Kigali is assumed to be around 32000 p/km². Such high density living will be in the inner city area and along the transit corridors. The average plot ratio is assumed to be 2 . 35% of housing in Kigali is proposed to be high density creating 450,000 dwelling units (DUs). High density areas should have in average 222 DUs/ ha.

MEDIUM DENSITY HOUSING:

Medium density for Kigali is assumed to be around 27000 p/km². Such areas will be in the townships around the high density corridors. The average plot ratio for these areas is assumed to be 1.4 . 50% of housing in Kigali is proposed to be medium density creating 649,000 DUs. Medium density areas should have in average 156 DUs/ha.

CORRESPONDING COMMERCIAL CENTRE				
	INTERNATIONAL CBD			
٠	REGIONAL CENTRE			
•	Fringe centre/ Town centre			
٠	N E I G H B O R H O O D CENTRE			

LOW DENSITY HOUSING:

Low density for Kigali is assumed to be around 5000 p/km². Such areas will have single family & row houses. The average plot ratio for these areas is assumed to be 0.5 . 15% of housing in Kigali is proposed to be low density creating 195,000 DUs. Low density areas should have in average, 40 DUs/ ha. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

5.3.2 BROAD LAND REQUIREMENTS FOR COMMERCIAL FACILITIES

Kigali's GDP is projected to be RWF 21,284 bn, witnessing an average growth rate of 8.6% per annum. It is projected that the services sector will represent 62.9% of this GDP share. The total workforce of Kigali in 2040 is estimated to be 2.33 million. The employment in the services sector is estimated to be 1.63 million by 2040.

To provide the variety of spaces needed for the services sector a broad land use for the commercial facilities is required. The commercial facilities in Kigali is composed of the following categories:

- Retail/ Shopping
- Offices

The standard for the provision of total retail space in Kigali is derived from comparing the total commercial space requirements of several countries. A total commercial space of 1 m² per person is proposed for Kigali. Similarly, 1.2 m² per person of office space is proposed for Kigali. A detailed description of the commercial facilities is explained in Table 5.3. The commercial facilities are generally proposed to be integrated with the regional center, city centers, town/ community centers, and neighborhood centers.

5.3.3 BROAD LAND REQUIREMENTS FOR TOURIST FACILITIES

The Sustainable Tourism Development Plan proposes 4000 rooms in Kigali by 2020. With the increased inflow of international as well as local tourism, Kigali will require more hotel rooms by 2040. A detailed description of the tourism facilities required in Kigali is explained in Table 5.4.

5.3.4 BROAD LAND REQUIREMENTS FOR INDUSTRIES

It is projected that the industrial sector will represent 36.1 % of the GDP share. The employment in the services sector is estimated to be 0.67 million by 2040. To provide the variety of industrial spaces a broad land use for the industrial sector is required. The industrial facilities in Kigali is composed of the following categories:

- Manufacturing
- Logistics
- Light Industries in Towns

The Manufacturing sector will have 50% share of the employment, while the Logistics will take up 10%. Industries in townships will take 40% of the employment share. The industrial facilities standards for Kigali has been derived by comparing the planning standards of various countries. Planning Standard of 50 m²/p is provided for the manufacturing sector, and 120 m²/p for the logistics sector. Similarly, 40 m²/p is provided for the light industries within the towns. A detailed description of the industrial facilities is explained in Table 5.5.

5.3.5 BROAD LAND REQUIREMENTS FOR PUBLIC FACILITIES

The standards for the provision of public facilities in Kigali is proposed after reviewing similar standards that have been proposed in the Singapore, South Africa and the previous Nyarugenge detailed physical plan. Certain standards such as the school and health centre provisions as proposed by the respective Ministries and National Land Use Plan were studies before the current proposal. The broad land requirements for public facilities are presented in Table 5.6. 5-6% of land is provided for Public Facilities in Kigali.

Table 5.3 Broad Land Requirements: Commercial Composition Year X

	Plot Ratio	RETAIL			OFFICES			Total Area	Total Floor Area
Provision Standard (m ^{2/} per)		1		1.2					
COMMERCIAL FLOOR AREA (MIL M ²)		5			6				
SPACE DISTRIBUTION		%	GFA (MIL M ²)	AREA (SQKM)	%	GFA (MIL M ²)	AREA (SQKM)	(км2)	(MIL M2)
CBD	3	40%	2.00	0.67	40%	2.40	0.80	1.53	4.60
REGIONAL CENTRE	2	20%	1.00	0.50	20%	1.20	0.60	1.14	2.28
TOWN/FRINGE CENTRE	2	20%	1.00	0.50	20%	1.20	0.60	1.14	2.28
OTHERS COMM	2	10%	0.50	0.25	20%	1.20	0.60	0.93	1.85
NCs	1	10%	0.50	0.50	-			0.50	0.50
TOTAL		100%	5.00	2.42	100%	6.00	2.60	5.23	11.50

Table 5.4 Broad Land Requirements: Tourism Facilities Year X

	HOTEL							
PROVISION STANDARD (M ² /PER)		0.1						
COMMERCIAL FLOOR AREA (MILL M ²)			0.5					
SPACE DISTRIBUTION	%	% (MIL M ²) ROOMS* AREA						
CBD	40%	0.20	3,333	0.07				
REGIONAL CENTRE	15%	0.08	1,250	0.04				
TOWN CENTRE	15%	0.08	1,250	0.04				
OTHERS COMM	30%	0.15	2,500	0.08				
NCs	-		-					
TOTAL	100%	100% 0.50 8,333 0.22						
* BASED ON AVG 60 M ² /ROOM	* BASED ON AVG 60 M ² /ROOM							

Table 5.5 Broad Land Requirements : Industrial Composition Year X

MANUFACTURING			LOGISTICS			Light
Floor Area (mil m2)	Area (km2)	%	Floor Area (mil m2)	Area (km2)	%	Floor Area (mil m2)
16.75	23.93	9.4	8.04	16.08	6.29	10.72

Note: Manufacturing: 50% of employment, Logistics: 10% of Employment, Industries in townships 40% Plot Ratio: Manufacturing - 0.7, Logistics- 0.5, Industries in townships - 1.0 Logistics: 120m²/worker, Manufacturing: 50m²/worker, Industries in townships: 40m²/worker

INDUSTRIES IN T	Total Area		
Area (km2)	%	Area (km2)	
10.7	4.2	50.73	

		South Africa (cape town)	Singapore	PROPOSED FOR KIGALI
Commercial	NEIGHBOURHOOD CENTRE	5 min walk to local market; 1 per 5000 population, 0.2 - 4 ha	1 per 13,000 - 20,000 population, 1.7 ha site	1 PER NEIGHBOURHOOD; 1.2 HA SITE.
	TOWN CENTRE	DATA NOT AVAILABLE	1 PER TOWN, 17-25 HA SITE	1 per township; 12.0 ha site.
	REGIONAL CENTRE	DATA NOT AVAILABLE	1 PER 0.5 MILLION, CATCHMENT RADIUS - 5 KM , 57 HA SITE	1 PER 0.5 MILLION, 50 HA SITE.
EDUCATIONAL FACILITIES	Primary School	1 per 5500 population, Max walking dist. 2.25 km. MIN 2.8 ha site. (inclusive of field)	1 per 13,400 population. 1.8 ha site	1 PER NEIGHBOURHOOD (15,000-20000 POPULATION). 1.5 HA SITE.
	SECONDARY SCHOOL	1 per 12500 population, Max drivinging time. 15 mins min 2.8 ha site, (inclusive of field)	1 per 19,150 population. 3.0 ha site	1 per 20,000 - 25,000 population. 2.4 ha site.
	Primary + Secondary School (Combined)	DATA NOT AVAILABLE	DATA NOT AVAILABLE	2.8 ha site. (Based on existing school sites)
	Vocational / ICT Institute	1 per 100,000 population, 1 ha site	1 per town. 5.0 ha site	1 per township. 5.0 ha site.
	HIGHER EDUCATION INSTITUTE	1 PER 1 MIL POPULATION, 8 HA SITE	1 per 500,000 population. 6.0 ha site	1 per 500,000 population. 6.0 ha site
SOCIO- CULTURAL FACILITIES	COMMUNITY HALL*	1 per 10,000-60000 pop; Max travel time 30 mins; 0.5 ha site.	1 per 40,000 population. 0.4 ha site	1 per 5,000 population. 0.5 ha site.
	REGIONAL LIBRARY	1 per 40000- 70000 population, min size 0.03 ha	1 per 65,000 population. 0.4 ha site	1 per 500,000 population. 0.5 ha site.
	RELIGIOUS FACILITY	1 per 3000 - 6000 Population; 0.15 - 1 ha site, distance of 2 km	1 per 25,000 population. 0.2 -0.45 ha site	1 per neighbourhood (15,000- 20000 population). 0.5 ha site.
	CEMETERIES	1 per 100,000 people 15.6 ha over 30 years (2000 graves per ha)	DATA NOT AVAILABLE	1 per Township 20 ha over 20 years
	MUSEUMS/ CULTURAL CENTRE ETC.	1 per 50000 (SMALL MUSEUM, SITE & PURPOSE SPECIFIC) 1 per 50000 (performing arts centre, site & purpose specific)	DATA NOT AVAILABLE	1 per township. 1.5 ha site.
HEALTH FACILITES	HEALTH CLINIC *	0.2 ha per 5000-20000 population 0.5 ha per 30000-50000 population 1 ha per 60000-70000 population	Served by private practitioners as part of commercial facilities	1 per neighbourhood (15,000-20000 population). 0.5 ha site.
	Polyclinic	1.5 ha per 60000 - 120000 population max vehicular travel time of 30 mins	1 FOR MINIMUM POPULATION OF 150,000 (EXCLUDING PRIVATELY OPERATED CLINICS). 0.5 HA SITE FOR 150,000 - 200,000 POPULATION	1 per township. 5.0 ha site. Max travel time of 30 mins.
	REGIONAL HOSPITAL	district hospital: 450000 population; 5 ha site regional hospital: 1 million population; 7 ha site teaching(specialist) hospital: 4.5 million population; 35 ha site	4.5 beds per 1,000 population. 5.0 ha site	1 per 500,000 population. 5.0 ha site
Parks & Open Spaces	Neighborhood Park	0.4 ha per 1000 Population, 20 min walking distance	DATA NOT AVAILABLE	1 PER NEIGHBOURHOOD (15,000-20000 POPULATION). 1.0 HA SITE
	Town Park	(district /regional park) 0.2 ha per 1000 Population; 20min by public transit	1 per town. 10 ha site	1 per township. 6.0 ha site
	Sports Field	0.56ha per 1 000 people (+ additional 0.3/0.4ha per 1 000 in Metropolitan areas for higher order facilities) 1 per 60000 population, Grouping of fields and/or sport facilities, 1.5- 2.5 ha	1 per 125,000 population. 3.0 ha site	1 PER TOWNSHIP . 1.5 HA SITE. (NEAR TO SCHOOLS OR COMMUNITY CEN- TRES OR COMBINE WITH PARKS.)

Table 5.6 Public Facilites Provision Standards

		SOUTH AFRICA (CAPE TOWN)	Singapore	
SPORTS & RECREATION	SPORTS CENTRE (WITH SWIMMING POOL AND STADIUM)	Sport stadia , 1 per 300,000 population (with tracks & 3000 seats) Regional sports arenas 1 per 250000-500000, 0.5 ha (Indoor sports halls may host non sporting events) International sports complex, 10 per 1.5 million, 3 ha site	1 per 125,000 population	1 FOR EV
	FIRE STATION	1 PER MIN POPULATION OF 100000, 0.3 ha suburban station, 1.2 ha regional station	1 to cover 5 - 8 mins response time. 0.4 - 0.6 ha site	5 MIN
	GOVERNMENT/ MUNICIPAL OFFICES	DISTRICT OFFICE - 40000 - 140000 POPULATION, TRAVEL TIME 30 MIN MUNICIPAL OFFICE - 1 PER SUB REGION/ 500000 POP., 0.3 - 1 HA SITE	DATA NOT AVAILABLE	1
*(as part of neigh	borhood centre)			

5.3.6 BROAD LAND REQUIREMENTS FOR ROADS & INFRASTRUCTURE

The current provision for roads in Infrastructure is low at 3.1% of the land use. However, in the future with population and economic growth, and implementation of proper planning the share will increase. The standard also considers the undulating terrain of the city. The standard for the provision of roads and infrastructure in the Kigali is proposed at 18% of total urban area in 2040.

5.3.7 BROAD LAND REQUIREMENTS FOR RECREATION SPACES

Open Spaces includes sports and recreation areas, and urban parks and open spaces. Provision of 4m² per person of open space in urban areas is proposed for Kigali. which is exclusive of wetlands, nature areas etc.

5.3.8 BROAD LAND REQUIREMENTS FOR SPECIAL USES:

Special Uses incorporates defence areas, quarry land, prisons, graveyards and special strategic vacant land. In the broad land use, 3-4% of urban land is provided for Special Uses.

Table 5.7 Proposed Kigali Broad Land Requirements - 2025 & Year X

		% OF URBAN EXISTING	% OF URBAN 2025	% OF URBAN YEAR X
PROTECTED FOREST / WETLAND/ WATERBODY		33%	75%	65.1%
AGRICULTURE		50%		
URBANIZED AREA (%)		17%	25%	34.9%
Area		731.27	731.27	731.27
POPULATION		1.2 MILLION	2.9 MILLION	5 MILLION
GROSS DENSITY		1670 р/км ²	3950 р/км ²	6850 р/км ²
GROSS URBAN DENSITY		11000 р/км ²	15850 р/км ²	19600 р/км ²
	RESIDENTIAL	9%	75 км² (41 %)	113 км² (44%)
	INDUSTRIAL	0.4%	24 км² (12.5 %)	51 км² (20%)
	COMMERCIAL + MIXED USE	0.4%	3 км² (1.5 %)	5 км² (2%)
	TRANSPORTATION, INFRASTRUCTURE & UTILITIES	3.1%	44 км² (24 %)	46 км² (18%)
URBANIZED AREA	SPECIAL USE	1.6%	7 км² (4 %)	8 км² (3%)
	Urban Recreational Open Spaces	0.2%	18 км² (10 %)	20 км² (8%)
	PUBLIC FACILITIES	1.6%	11 км² (6 %)	13 км² (5%)
	TOTAL BUILT-UP AREA	119 км²	182 км²	255 км² (100%)



Fig.5.1 Projected Urbanization in Kigali



very 500,000 population. 6.0 ha site.

NUTES RESPONSE TIME. 0.5 HA SITE.

1 Sector office per Sector. 1 District office per District.

OEVELOPMENT STRATEGIES AND CONCEPTS FOR KIGALI



Ensuing the guiding principles set by the Vision, Goals and Strategies, key development strategies and concepts are developed which will provide the long-term development direction for the transformation of Kigali.

6.1 Development Concept Strategy:

TO DECENTRALIZE EMPLOYMENT CENTERS IN KIGALI:

• Decentralization of commercial centres with the establishment of regional centres and fringe centres to reduce necessity for residents to commute to the CBD in Nyarugenge for business activities.

A hierarchy of commercial centers is proposed for Kigali besides the CBD and the main commercial corridors. Establish multiple new regional centers which will direct the city's expansion away from the current urban areas. Similarly, key development corridors integrated with public transit to be opened up. The new town centers and neighborhood centers will be distributed along these corridors to restructure the city into self sufficient new townships which will reduce travelling to the CBD for business activities.

• Decentralization of major industrial estates in 4 locations to distribute the employment in the manufacturing sectors.

Kigali is projected to have it share of industrial and service sector. The high demand for industrial space in the current FTZ at Gasabo suggests the requirement for more industrial districts in Kigali. It is necessary to have industries and employment centers strategically located across the city. Also key areas

Fig.6.1 Development Strategy for Kigali

at the periphery of the city will need to be developed as logistic hubs. Such manufacturing and logistics hubs are strategically distributed in all the districts.

Integration of smaller scale light (nonpollutive) industries within residential areas to provide jobs near home.

Bringing work closer to homes to reduce travelling time is one of the strategies of the master plan. Smaller light industries such as workshops, garages and nonpollutive industries are proposed to be located within the townships and close to the residential areas.

DEVELOPMENT OF COMPACT, VIBRANT & TRANSIT ORIENTED CITY.

• Develop high denstiy compact developments

Promotion of higher density developments to better optimize the urban land, and infrastructure to reduce necessity to travel and thus reduce the carbon footprint of the city. Currently only 17% of kigali is urbanized with many unplanned and sprawling developments. In the future, urbanization will be limited to less than 35% with strong emphasis on providing facilities and amenities at walkable distances.

• Development of a comprehensive public transit network

Development of mass rapid transit (BRT) to facilitate efficient urban transport system and to create a higher density mix development corridors along the BRT route to be the vibrant "work-live-play" corridors in the city.

• Development of an efficient highway and road network

To cater to the projected economy and

population, Kigali will require more roads in the future for smooth through traffic. A system of hierarchy of roads to be developed for the city. A ring road around the city will divert the heavy vehicles from unnecessarily entering the city.

• Promote Green Transport and Non Motorized Transit

Promote green connectivity (linkages) and development porosity to ensure that the city will be pedestrian and bicycle friendly.

DEVELOPMENT OF AFFORDABLE HOUSING AS THE DRIVER OF URBAN TRANSFORMATION IN THE SUBURBAN AREAS

• Revitalization and redevelopment of unplanned & low density built up areas Currently more than 78% of urban areas are unplanned in Kigali. The existing dense unplanned areas is to be restructured, decongested, and reorganized. Developments in high-risk areas is to be relocated. Develop strategies to be redevelop these unplanned areas in an equitable manner.

• Comprehensive townships in the Suburban areas

Initiate affordable housing development in the suburban areas to meet the housing demand, to consolidate land and shape the urban density in the suburban areas. Plan and develop affordable housing as a comprehensively planned township to offer better living environment in the suburban areas. Plan and develop the integrated township such that good standard infrastructure and public facilities could be developed in integration with the township project.

PRESERVATION OF URBAN HERITAGE & ENHANCEMENT OF PUBLIC GREEN SPACES AND DEVELOPING DISTINCT **IDENTITIES**

• Conserve Built Heritage

Identify urban heritages which include buildings of historical value, complexes, objects and streets for conservation to preserve city's identity and heritage.

• Conservation and integration of all nature areas:

Restore natural eco-system including wetland, forest and other naturally sensitive areas. 65% of the areas to be conserved as natural assets. The nature areas provide a balanced relief to the high-density urban development while conserving the biodiversity.

• Develop a Green City with variety of open spaces

Develop the city landscape master plan and identify and design key public parks, to be the city features. Develop horticulture centres to introduce colourful flora in the urban landscape that balances the dense environment in the city.

• Establish new urban features with distinct identity

Variety of distinct attractions will create new identities as well as economic opportunities within the city. Kigali is the main tourist hub in Rwanda. It require facilities and features to cater to the needs of visitors. Similarly other regional amenities for citizens such as theme parks, entertainment & cultural districts, botanical gardens etc. will create distinct identity for the areas.

TO MANAGE AND IMPROVE THE ENVIRONMENT & INFRASTRUCTURE:

• Develop an integrated waste and storm water management system:

Protection of the extensive wetlands in Kigali is one of major environmental objectives. Integrate the wetlands with the storm water management initiative to counter flooding and develop a comprehensive green infrastructure. Similarly, integrate the storm water system with the city's green system. Manage the wastewater from the urban areas as well as the industries to ensure prevention of ground water contamination.

LAND CONSOLIDATION AND LAND RESERVE FOR FUTURE NEEDS

• Land Conslidation

Consolidate land for the benefit of general public, especially for the future infrastructure development.

• Land Reserve for the future

Acquire & reserve urban land at key locations within the city for future needs of economic and infrastructure development.



Fig.6.2 Linear City Concept (top), Radial City Concept (below)


Fig.6.3 Conceptual Strategy for developing affordabe housing within township and eco-cells

6.2 Development of Concepts:

Following the direction set by the development strategies; two concept options are proposed which explore the alternative directions of future physical development of Kigali. The options explore various employment, housing, transit and transportation opportunities. The two developed concepts are:

- Linear City
- Radial City

The common essence of the two concepts are broadly illustrated through the diagrams in Fig.6.23. and further discussed hence:

6.2.1 A NEW DEVELOPMENT DIRECTION:

The concept explores a significant new direction of urban growth moving away from the fragmented, piecemeal and sprawling development, as seen in the city today. Addressed by both the concept options, Kigali is proposed to have multiple compact new townships which are well integrated with the transit network connecting the city. Both the concepts limit the urban development to 35%.

Housing Estates, Neighborhood Clusters & Townships

The concepts emphasises creating sizeable housing estates (eco cells) within neighborhood clusters with provision of larger comprehensive amenities at an accessible distance. Such neighborhood clusters combine to form integrated townships.

The township consists of several components and scales of communities. The basic unit of the township is the development parcel or Eco-Cell. This Eco-Cell community comprises of a cluster of dwelling units sharing a common green ensuring vehicular free playground and community space for 1000-1500 dwelling units within 2-3 ha development parcel.

Each such compact Eco-Cell will allow for a minimum of 20% landscape area for the residents to enjoy. Several such Eco-Cell will be linked through pedestrian connectors and parks to form a distinct neighborhood community. Each such neighborhood serving a designated population catchment will have its own recognizable and accessible centre with variety of facilities. Such neighborhoods communities are organized to eventually form the larger township community.

The township's catchment usually will vary from around 200000 to 300000 population. The township will have a distinct and accessible town-centre serving the the entire area which caters to larger amenities and facilities

The township is connected to other towns and city areas by high capacity urban roads. A high capacity mass transit system connects the various townships and other key city areas though the transit corridor. This is part of a city wide extensive transportation network. The transit corridor passes through the town centre, stopping at the transit nodes. Seamless transfer of people between various modes of transit occur at these transit nodes.

The townships comprise of variety of housing options of which affordable housing will be a major component. There will be high density living areas along the public transit corridor. Besides housing these townships will also cater to public amenities like schools, health centres, playgrounds, religious facilities, neighbourhood centres, retail areas, and employment areas.

TOWNSHIP DEVELOPMENT MODEL FOR KIGALI:

Each city is unique, similarly, Kigali with its distinct geography and social context and issues will need it's own solution. The governments restrictions in regards to funding needs to be acknowledged however this is supplemented by the strong commitment and leadership from the government. A sustainable solution to achieve the model for Kigali should be actively initiated by the government. The government should also in advance reserve key area along the transit corridors through strategic land banking.

The first phase of the township should be along the transit corridor which will primarily be high density mid-income housing. These houses will be developed by the government and sold at market value. However the surrounding basic infrastructure will be developed at this initial stage with costs tied in with the house price. With completed basic infrastructure the city can actively pursue higher density affordable housing as the next stage of development. The new affordable units now can be provided at subsidized value with added incentives and government backed security etc. It would be better for such developemnts to be carried in government land reserve areas to reduce the initial land costs. With the initial catalyst development underway, this potential model could be further developed through a PPP model.

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6.2.2 CONCEPT OPTION 1:

LINEAR CITY

The "Linear City" concept reinforces the existing east-west corridor in Kigali by concentrating transit oriented compact development in the central development spine and enabling integrated townships in newer areas.

Concept 1 recognizes the current development trend along the existing corridor and takes opportunity to capitalize on the existing growth pattern while organizing the new city around this central corridor. The key features of the proposal are:

• Strengthening of existing City Centre and Redevelopment of Central Corridor

The current city centre comprising of Muhima, Kimihurura, Kaciryu will remain as the main business centre in Kigali. The central corridor extends from this centre along the E-W corridor. This corridor is currently witnessing development pressure due to the its accessibility. The current growth pattern along the corridor which has many existing developments. The concept proposes for more residential and mixed use development in the corridor to further capitalize on its growth potential. The development will largely include rejuvenation and redevelopment of areas. The new development will require to be of high density in character.

• Development of new gateway nodes

A distinct new commercial centre is proposed at Kabuga, which will be a gateway to the predominantly eastern commercial corridor providing better linkage to the economic centres of East Africa such as Kampala, mairobi, Dar-Es-Salam. It will be a key transit node in the city and an important commercial node for both Kicukiro and Gasabo district. The development of Kabuga as a regional centre at the East will be implemented through redevelopment strategies and will be driven large public-private led developments.

Similar to Kabuga, Gahanga is proposed to become an important commercial node in Kigali. Gahanga currently experiences development pressures due to the availability of developable land. It has also be identified as a growth node by the KCMP. Gahanga is also strategically located between the proposed new international airport at Bugesera and the CBD, and has the potential to become an important regional centre. It will become the secondary gateway from the southern economic corridor.

• Townships with Transit Network:

A high capacity public transit system is proposed to serve the centre corridor which will be the main transit trunk for Kigali. The townships extend and grow from this central high density corridor. The new townships are proposed to be connected to the main trunk by a feeder transit corridor. This feeder system is proposed to be either BRT which runs on dedicated bus corridors or high capacity Buses. This transit network resembles a fish bone pattern, where the intersection between the trunk and the feeder are proposed to be developed as major transit nodes.



Fig.6.4 Linear City Concept







Fig.6.6 Linear City - Transit Network (left), Road Network (right)



Fig.6.7 Linear City - Employment Distribution (Left), Population Distribution (right)

• Redevelopment of Airport Land:

With the completion of the proposed new international airport, the role of the current airport as an functioning international airport is analyzed for this proposal. The proposal explores the potential of the land to solve the cities growing housing shortfall. The shifting out of the airport and redeveloping the land as a high density development with large affordable housing component will further strengthen the central transit corridor. The shifting out of the airport will also remove the height restrictions effecting the surrounding areas and promote new higher density





developments.

• Regional Connectivity:

The new airport highway will establish a strong connectivity with the international airport. Furthermore the development of Gahanga will establish a stronger link with Bugesera. Similarly, the new railway line to the SEZ will allow for a new growth potential along the central corridor. Provisions for this rail line to extend further north to the country is also created. The new freight line corridor in the future could also be extended to cater to passenger rail to the region and the airport.

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6.2.3 CONCEPT OPTION 2:

RADIAL CITY

The "Radial City" concept proposes the creation of new transit oriented development corridors and promotes development of new townships along it.

Concept 2 focuses on linking the development corridors radiating out from the CBD and connecting the various areas of Kigali to the city centre. The key features of the proposal are:

• New Development Corridors:

The concept proposed new development corridors for Gasabo and Kicukiro. The concept focuses on the new developments in the green field areas, while intensifying the inner city area surrounding the CBD. The radial city concept also emphasizes more proactive role of the government in securing strategic land banks in the developable areas of Kigali. The development corridor will connect key features of the city as well as the proposed new employment nodes. The 5 million projected population of Kigali will be distributed along these development corridors.

• Development of new Regional Nodes:

The concept proposes several new development nodes along the corridors. These nodes will be well integrated to the transit. Three new regional nodes are proposed which will be located in Masaka, Ndera, and Gahanga. These regional centres will cater to a larger catchment area and will include regional level facilities and commercial activities. The regional centres will also be key employment destinations in the city offsetting the pressure form the CBD. The regional centres will have a distinct identity and character. Gahanga is being proposed as a R&D and Science

Centre which capitalizes on the existing education institutes. Similarly Masaka is being proposed as a Sport City.

There will also be several town centres located along the corridor which will cater to the requirement of the township. The transit nodes will be located within the town centres.

• Townships integrated with BRT corridors:

The integration of the transportation plan and the proposed land use plan is necessary to achieve a well planned city. The transit corridor forms an integral component of the transportation plan. The transit corridor links the various townships in Kigali and makes travelling from one part of the city to another a seamless experience.

To ensure future high density development is proposed along these corridors, the government needs to secure the land to develop these corridors. The new proposed townships will be modelled around these transit corridors. The transit corridors initially will have Bus Rapid Transit with transit stops distributed at regular intervals. However in the future with enough population catchment and necessary funding, high capacity MRT corridor is proposed to be developed. The transit corridor is supported by local feeder system creating seamless travel.



Fig.6.8 Radial City Concept





Fig.6.10 Radial City- Transit Network (left), Road Network (right)



Fig.6.11 Radial City- Employment Distribution (left), Population Distribution (right)

• Airport retained for medium term

The proposal also anticipates the arrival of the new international airport in Bugesera and provides for proper connectivity between Kigali and the new airport. However in this option the airport is kept till the medium term after which it could be redeveloped. Since most of the development is focusing in the hinterland the retention of the airport will not effect the implementation of the concept. The exisiting airport will address the strategic needs of the capital city and can also promote aeronautic industrial clusters.

Fig.6.9 Radial City- Township model and Transit Corridor





• Regional Connectivity:

The rail line to the SEZ is proposed to be developed in the near future which will further strengthen the logistics role of the SEZ. The rail corridor will also cater to future passenger rail service linking the city to the Bugesera airport and the Southern Province. Provision for future extension of the line to the north of the country is also provided in the option. The radial road network with well spaced highways caters to smooth city travel and fast link to the new airport at Bugesera. The ring road also provides alternate bypass to heavy good vehicles travelling across the country.

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COMPARISION OF CONCEPT OPTIONS				
EVALUATION CRITERIA	LINEAR CITY	RADIAL CITY		
		Billion Di Director Di Di Director Di Di Director Di Di D		
GROWTH FOCUS	 Focuses on existing east- west corridor in the city Follows existing growth pattern and development demand High density development along the two corridor and medium density in the NS corridor 	 Focuses on newer less developed areas Growth nodes in greenfield areas High density development around the CBD and 3 Major Linear Medium Density Corridors 		
CITY STRUCTURE & COMMERCIAL DISTRIBUTION	 Development of two high capacity corridors: eastern & southern corridors. Distinct gateway node at Kabuga and Gahanga. 	 Radial extension of the city creating new growth corridors Multiple regional commercial nodes creating distinct new centers 		
Transport System	• A fish bone pattern transit structure which combines high capacity Mass Rapid Transit and feeder BRT lines.	• Multiple radial transit lines links to the centre with feeder system within the townships.		
GOVERNMENT INVOLVEMENT AND IMPLICATIONS	 Government as a Facilitator and Regulator –Lesser government intervention as the large part of implementation by rezoning. Lesser control on density optimization due to current trend of low density development along the EW corridor Need additional funding resources for MRT development. Relocation of existing Kigali International Airport to optimize on the potential for high density development in and around the airport. 	 Need additional funding for strategic land bank. Not impacted by the height constraints imposed by the existing airport. Government can play a larger role in providing of affordable housing. Requires proactive government intervention in terms of land acquisition to implement the Concept. Current airport remains operational till 2025. 		

Table 6.1 Comparision of Concept Options

6.3 COMPARATIVE ANALYSIS OF CONCEPT OPTIONS:

To enable the selection of the most suitable development concept for Kigali, the concept options are compared and evaluated as illustrated in Table 6.1 against the following criteria:

- Growth Focus
- Development Opportunities
- Employment Distribution
- Transport Systems
- Ease of Implementation

Option 1 (Linear City): requires less government intervention as it follows the growth pattern centred along the main development corridor. This option will be more difficult to implement as you will have to rely heavily on the market forces to achieve to the planning objectives. This option also requires the airport to be redeveloped.

Option 2 (Radial City): requires more proactive role by the government to secure adequat land banking for the township. The urban development in this option is more evenly distributed and features multiple growth nodes. This option also allows for the airport to be retained.

6.4 RECOMMENDED CONCEPT OPTION:

6.4.1 SELECTION OF PREFERRED CONCEPT OPTION:

In March & April 2012, the two concept options were presented to various stakeholders at city as well as district levels. Following key suggestions were expressed by the stakeholders during the various sharing sessions:

- Develop options on affordable housing which could be developed in Kigali. Discourage fragmentation of land by promoting newer plot of 2-3 ha for higher density cluster & multi-family developments. Also provide ideas for densification and amalgamation of existing small fragmented parcels.
- Retain the Imudugudus developed/ granted by the government upto the medium term of 2025.
- Regulate single family low density development and the necessity to

promote compact development. Necessity for higher density compact development, however also provide variety of choices by allocating some small portion of single family in smaller plots.

- Develop regulation and strategies for redevelopment and gradual development of areas.
- Integrate the nature and greens to create a develop a green network for the city.
- Develop a road network system while reviewing the various options.
- Formulate various implementation strategies with incentives and disincentives for developers.
- Retain the airport for strategic reasons in the medium term.

The Radial City Option was selected as the preferred option, which will be further developed in the subsequent stage. However, some key ideas from the linear concept option should also be included in the final option.

6.5 The Way Forward:

The selected planning concept option sets the broad planning directions and the regional structure of Kigali. This concept, however, is not cast in stone; a deeper planning analysis will be undertaken in the subsequent stage to refine the concept further before the structure plan is finalized. Task Order 3 (Conceptual Planning) involves transportation concept planning, preliminary traffic modelling, preliminary infrastructure proposal as well as the concept plan for the two districts. As per the stakeholder's request, a draft zoning plan will also prepared and presented for discussion.



Fig.6.12 Various Stakeholders Meetings held in Kigali





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APPENDIX 1: SOCIO-ECONOMICS STUDY OF KIGALI CITY 2010-2040

Rwanda: Socio-Economic Profile

RECENT ECONOMIC PERFORMANCE

RECENT GROWTH

Rwanda's recent economic performance has been widely recognized as a success story within Sub-Saharan Africa, averaging more than 7% annual growth over the last 5 years. The below figure illustrates that Rwanda has outpaced both the EAC and Sub-Saharan Africa during this period, and currently shows no signs of decelerating. The IMF projects growth of 6.8% in 2012 as domestic credit growth booms and the service sector continues to perform strongly.

The economy remains small at just under \$6 billion in 2011, but a GDP per capita of \$585 places Rwandan's as the second highest income per head within East Africa, behind Kenya. This achievement is considerable given the devastation from which Rwanda has had to recover following the genocide of 1994.

GDP AND EMPLOYMENT BY SECTOR

Post-1994 development in Rwanda has been driven by two phases of economic development; the first 5 to 10 years of rebuilding and return to investment in physical and human capital brought rapid growth without much transformation away from an agriculture-dependent economy. The second phase has seen a structural shift out towards a now dominant service sector, as well as strong growth in a nonetheless small industrial sector.

Rising agricultural productivity has allowed the sector to grow by 4.7% over the last 5 years despite employment growing by just 0.4%. In the meantime, labour has begun a shift to off-farm activities, both causing and as a consequence of growth in the industrial and service sectors. Off-farm employment now totals 1.4 million, or 28.3% of the workforce, compared to 0.44 million a decade ago (11.4%). The service sector has driven this transformation with average growth of 9.8% since 2006, and an increasing share of employment. Employment growth in the industrial sector has outpaced output, suggesting that growth has not been a result of increasing productivity levels, unlike in the other two sectors of the economy.



Figure 1: GDP Growth in Rwanda and the Region, 2008-2011 Source: Rwanda Economic Update November 2011, World Bank Group



Figure 2: GDP by Sector, 2006-2011 Source: National Institute of Statistics, GDP Estimates 2010/11, 2005 prices

Table 1: Rwanda GDP Indicators, 2009-2012

IMF	2009	2010	2011 (еѕт.)	2012 (Ркој.)
GDP GROWTH (CONSTANT PRICES)	4.1	7.5	7.0	6.8
GDP (US\$ BILLIONS, CURRENT PRICES)	5.216	5.578	5.971	6.476
GDP PER CAPITA (US\$, CURRENT PRICES)	533	558	585	621

Source: Rwanda Economic Update November 2011, World Bank Group

Table 2: GDP and Employment by Sector, 2010/11

	GDP		EMPLOYMENT	
SECTOR	RWF BN.	5-year growth	TOTAL	5-year growth
AGRICULTURE	1,205	4.7%	3,600,000	1.1%
INDUSTRY	482	8.6%	270,000	9.9%
SERVICES	1,589	9.8%	1,136,000	9.4%
TOTAL GDP	3,277	7.6%	5,011,000	2.1%

Source: National Institute of Statistics, GDP Estimates 2010/11 and EICV-III Household Survey data

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The industrial sector currently contributes 16% of national output, with half of this coming from the construction subsector. Apart from a brief decline during 2009/10 as a result of the global economic crisis, the construction sector has exhibited high growth in recent years (14% average in the last 4 years) and has also been a key catalyst in drawing labour into off-farm jobs: the industrial sector has created around 100,000 additional jobs over the last 5 years. Much of the construction boom has been concentrated in the urban centres, and in particular Kigali City.

Manufacturing has grown by an average of 5% over the last 5 years, and currently contributes 7% of GDP and just under half of industrial output. Rwanda's manufacturing sector consists mainly of food processing and beverages, which contribute around RWF 90 billion (approx. \$150 million). Plans are afoot within both the public and private sector to expand agro-processing further as well as processing of non-metallic minerals into industrial inputs.

The service sector has shown consistently high growth over the last 5 years as a result of rising employment and labour productivity. The sector has created 413,000 jobs during this period. Growth has been broad-based in terms of subsectors, with the largest being wholesale & retail trade at RWF 308 billion (\$513 million) in 2010/11. Other key subsectors include transport, storage & communication (\$332 million) as well as real estate & business services (\$268 million). Public administration, health & education make up \$490 million, and financial & insurance services have seen a recent surge, reaching \$127 million.

SUB-SECTOR EMPLOYMENT

The breakdown of off-farm employment by sector is not available for 2010 from EICV3 at the current time, however once available will be key in developing policies and targets. Data is available for 2005 however, from EICV2. Estimates up until 2010 are made using estimates from the Ministry of Trade and Industry, based upon overall growth in off-farm employment (12.3% p/a) and individual sub-sector growth.

Table 3: Employment by Sub-Sector, 2005-2010

SECTOR	Employment	
	2005	2010 (ЕЅТ.)
CONSTRUCTION	66,251	105,611
MINING & QUARRYING	18,309	29,186
MANUFACTURING	80,583	128,458
TOURISM & RECREATION	8,818	14,057
GENERAL TRADE	299,265	556,273
TRANSPORT & COMMUNICATION (INCL. ICT)	56,971	105,898
FINANCE & INSURANCE	12,724	23,651
OTHER	339,079	442,866
TOTAL	882,000	1,406,000

level.

General trade employs the largest number

of workers, generally through micro and

small-sized firms, with construction and

manufacturing playing an increasingly

important role in off-farm employment,

contributing almost a quarter of a million

jobs between them. Finance and insurance

employs around 24,000 workers, but this is

expected to increase as financial services

reach wider geographically and by income

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

Table 4: Enterprises by Size (No. of Employees), 2011

	MICRO (1-3)	SMALL (4-30)	MED (31-100)	LARGE (101+)
FIRMS	114,329	8,548	513	106
% OF TOTAL	92.6%	6.9%	0.4%	0.1%
			1 1	

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

Agriculture,
3,600,000

Figure 3: Employment by Sector, 2010 Source: National Institute of Statistics, GDP Estimates 2010/11, 2005 prices

The above table shows the composition of enterprises by size based upon the number of employees. It indicates that the vast proportion of firms are classified as micro (92.6%), with just 106 firms employing over 100 workers. In fact, these 106 firms employ 16% of the employees enumerated in the study, mainly permanent workers for firms with permanent premises. Large companies within the industry and service sectors are few, resulting often in monopoly powers in markets, and elsewhere little economic activity. It is expected that as foreign and local investment increases and the private sector develops, this underlying structure may become more supportive of a larger base of big firms.

INTERNATIONAL TRADE

Exports of goods grew by an average rate of 12.9% between 2007 and 2010, and in 2011 increased by over 52%. With the global economic crisis adversely affecting trade of coffee and minerals in particular in 2009, a strong recovery has been witnessed with minerals in particular driving growth. The mining sector brought in US\$159 million in export revenues in 2011 following rising international prices and output of Rwandan mines. Exports remain dominated by traditional exports of tea, coffee and minerals, which contributed 77% of all exports in 2011 (blue line in Figure 4). Goods exports covered 27% of goods imports in 2011, compared to 30% coverage in 2007.

Imports of goods have outstripped exports over the last four years however, with growth of 23.1% between 2007 and 2010, and reached \$1.42 billion in 2011.

Consumer goods represent the largest share of goods imports at 29%, and are dominated by food products at \$156 million (especially animal & vegetables fats and oils, cereals and sugar) as well as pharmaceutical products (\$79 million). Intermediate imports are mainly for construction materials (\$154 million) and other industrial inputs (\$185 million). Capital imports rose by 10% in 2011 reaching \$349 million due to large public projects such as Kigali Convention Centre (KCC). Public capital imports dominate total capital imports, with only 10 to 20% of total capital imports being for the private sector over the last 5 years. Imports of energy and lubricants (mainly fuel) grew by 23% between 2010 and 2011 in part due to rising demand from the domestic economy. However, growth of fuel and food prices has been high and has driven up the cost of both consumption and energy imports.



Figure 4: Goods Exports by Type, 2002-2011 Source: National Bank of Rwanda (BNR) Trade in services has shown a moderate deficit in comparison to trade in goods, with tourism being Rwanda's major foreign exchange earner. Outflows of US\$608.4 million were comprised predominantly of freight and other transportation services, totalling US\$390.5 million, and transportation costs clearly represent a large cost that the domestic sector is not currently providing alternatives to.

LOCAL AND FOREIGN INVESTMENT

Foreign Direct Investment (FDI) peaked at US\$118.7 million in 2009 following some large one-off investments, but declined to almost a third of this figure in 2010. In 2011 a recovery seems to be underway with growth of 41.8%, however flows remain low and volatile in comparison to other sources of foreign exchange. Large investments from both local and foreign, public and private sources include the Kigali Convention Centre (KCC) and Marriott hotel as well as investments in the energy sector such as the Lake Kivu methane gas extraction plant. The Bugesera International Airport is also a flagship programme that will be a key investment in the next 5-year period.

Large investments in construction, energy and telecommunications sectors are currently planned, with investment registered by the Rwanda Development Board (RDB) reaching \$620 million in 2011, compared to \$381 million for the 2010 calendar year. This represents new investment that will be realized over a multiyear period, with particularly notable new investors including BhartiAirtel, an Indian telecoms company with an



Figure 5: Goods Imports by Type, 2002-2011 Source: National Bank of Rwanda (BNR)

increasing presence in Sub-Saharan Africa. Airtel have registered planned investment worth \$102 million. Elsewhere, DSI Energy Ltd has registered planned investment of \$73 million for a 30MW solar power project. Rwanda has fast-tracked the privatisation process of key state firms over the last year following the successful Initial Public Offering (IPO) of Bralirwa shares (the largest brewery firm in Rwanda). The Government divested a 25% stake in the Bank of Kigali through an IPO at the end of June 2011, which raised \$63 million and was oversubscribed by 274%.

Table 5: Foreign Direct Investment, 2007-2011

	2007	2008	2009	2010	2011E
FDI (\$ MILLIONS)	82.3	103.4	118.7	42.3	60.0

Source: MINECOFIN / IMF data

The Government of Rwanda has lined up an additional 5 state-owned companies in the telecommunications, banking, cement and insurance sectors for partial sale of shares through future IPOs, however the Capital Markets Authority Council (CMAC) recently stated that it is unlikely further IPOs will be held in 2012. This followed 3 firms shelving plans to list in 2012.

Finally, the economy receives large input from grants or foreign aid flows, channelled through government or otherwise. Total grants are projected to reach US\$843.4 million in 2011, growing at an average rate of 16.7 year-on-year since 2007. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

KEY ISSUES, CHALLENGES AND IMPLICATIONS

The mid-term outlook for Rwanda depends on increased investments in core sectors like energy and transport, and the continued growth of construction and service sectors that has been the key driver of recent success. Progress has been made in improving the skill base of the labour force, and this is exhibited in rising productivity in agriculture and services as well as the shift towards off-farm employment seen. There is much scope for improvement over the medium to long run however, with only a fifth of the workforce having been through secondary education. Dependence on a few key export sectors and importation of industrial inputs provides an additional constraint, but also potential opportunities for the domestic market.

SOCIO-DEMOGRAPHIC PROFILE

The key source of comprehensive data on demographic and social indicators for Rwanda is the recently completed Third Integrated Household Living Conditions Survey, known as EICV3. This section borrows heavily from the findings of the 2010/11 report and its predecessors, carried out in 2000/01 and 2005/6. Unfortunately, raw data is unlikely to be available until May 2012 due to data cleaning issues.

The total population in 2010/11 was estimated at 10.76 million by the household survey, compared to 9.49 million in 2005/6. This represents annual population growth averaging 2.54% growth per annum. The rural population has increased as a share of the total population from 83.4% in 2005/6 to 85.2% in 2010/11. This is despite offfarm employment increasing by 12.3% over the last decade. This indicates that

(a) rural employment is moving into more structured, value addition activities, and/ or (b) urban unemployment has fallen and agricultural practices within urban areas have been replaced with off-farm employment.

By province, Kigali City inevitably has the largest share of urban to rural population at 85.2%, up from 83.4% in 2005/6. Elsewhere, 12.6% of the population in Southern Province are classified as living in urban areas, a decrease of 1.7 percentage points. In fact, the urban population has dropped in all provinces outside of Kigali City despite the population increasing. This is mainly due to higher birth rates in rural areas, and not due to internal migration.

Of the population aged over 15 years, 19% are estimated to have migrated across the country in the last 5 years. Over 40% of those in urban areas have migrated in the last five years, and the same was true of the five years before that. Richer individuals seem to move more often, based upon consumption levels. Kigali City's population is made up of 58% recent migrants. Nonetheless, the direction of most migrants is to rural areas (64%), often from other rural areas, and most commonly for family reasons (36%, employment (31%) or lack of land (15%). Of all migrants, 27% head to the capital compared to 19% in 2005/6. In this case, 54% go to Kigali for employment, 28% for family and 8% for marriage.

The gender share has remained constant since 2005/6, with 52.6% of the population being female. Those under 40 years of age constitute 83% of the population, indicating that the vast majority of the population is young. Some 5,888,000 are of working age (16 or above), or 54.7% of the population,

compared to 53.9% in 2005/6. The mean number of persons per household has decreased slightly over the same period, from 5.0 in 2005/6 to 4.8 in 2010/11.

KEY ISSUES, CHALLENGES AND IMPLICATIONS

Off-farm employment has not yet been the result of large movements in labour from rural to urban areas, although Kigali City has a larger proportion of migrants than other areas of Rwanda. As agricultural productivity continues to rise, population and land pressures are likely to create surplus labour. These "push" factors can be combined with the "pull" factors of higher income job opportunities and standards of living in Kigali and other urban centres. The extent to which urbanisation is expected to occur in the coming years is considered in the forecasting section of this report, based upon trends, existing analysis, economic modelling and policy initiatives.

Kigali City: Socio-Economic Profile

Currently, data on production and output for Kigali City specifically is not disaggregated in the national accounts. However, GDP is calculated according to an aggregation method of production by sector, and weights for production (Kigali-based as a percentage of total) are constructed using capital stock data from the Establishment Census 2011.

Output can be calculated in a number

of ways that should in theory yield the same results, but that have different data requirements. For the purposes of the District Development Plan, output based upon production of localised firms as opposed aggregated net income of the local population is assumed to be more directly useful, and so aggregated production is the preferred method used in this analysis. An additional issue with calculating output for a city/province comes in reflecting the level of intra-national trade between provinces and the linkages between sectors as inputs to others. Once again, aggregated



Figure 6: Establishments by Size, Kigali, 2011 Source: Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF).

	ESTABLISH- MENTS	Micro	SMALL	MEDIUM	LARGE
NYARUGENGE	12,351	10,779	1,322	64	15
GASABO	9,748	8,526	914	57	15
KICUKIRO	7,076	6,204	704	45	16
KIGALI CITY	29,175	25,509	2,940	166	46
% Rwanda	24%	23%	39%	38%	46%

Table 6: Establishments by Kigali Districts and Size, 2011

Source: Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

production within Kigali can be collected, whereas income or expenditure data is difficult to limit to a single area due to intranational mobility.

ESTIMATING OUTPUT OF KIGALI CITY

The Establishment Census 2011 enumerated 123,526 enterprises within Rwanda, detailing by location, sector, number of employees and capital stock. The results can be used to proxy the share of output for a sector that is concentrated within Kigali City by using the number of establishments and their size (based on capital) to construct weights. Both the Establishment Census and national accounts use the ISIC code approach to coding sectors and are thus comparable.

Table 6 indicates that 24% of all establishments are within Kigali City, with an increasing share as firm size increases. Put differently, Kigali City has a high concentration of larger firms than other provinces.

Table 7 below shows that there is a particular concentration of firms within wholesale and retail trade, covering over 62% of establishments. Elsewhere a total of 798 manufacturing enterprises are in Kigali, from a national total of 4,559 (18%), 203 financial & insurance sector firms (21%) and 227 ICT firms (41%).

Output will however depend on more than the number of firms: specifically:

- The size of firms may differ by sector;
- The productivity of firms may differ by sector;
- Both the size and productivity of firms in a particular sector may differ between Kigali and elsewhere (better access to

Table 7: Establishments by Kigali Districts and Sector, 2011

	GASABO	KICUKIRO	NYARUGENGE	TOTAL
AGRICULTURE, FOR- ESTRY AND FISHING	25	7	43	75
MINING AND QUARRYING	4	4	3	11
MANUFACTURING	335	196	267	798
CONSTRUCTION	29	26	33	88
WHOLESALE AND RETAIL TRADE	6111	4798	7737	18646
TRANSPORTATION AND STORAGE	15	21	57	93
ACCOMMODATION AND FOOD SERVICES	1667	854	1140	3661
INFORMATION AND COMMUNICATION	83	41	103	227
FINANCIAL AND INSUR- ANCE ACTIVITIES	50	32	121	203
REAL ESTATE ACTIVITIES	5	8	6	19
PROFESSIONALS, SCIEN- TIFIC AND TECHNICAL	350	370	1699	2419
EDUCATION & HEALTH	128	79	74	281
ARTS, ENTERTAINMENTS AND RECREATION	21	11	19	51
OTHER SERVICES ACTIVITIES	699	485	670	1854
OTHER ECONOMIC ACTIVITIES	277	425	662	1364
TOTAL	9,799	7,357	12,634	29,790

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

skilled staff, infrastructure, consumers etc.).

For this reason, output for Kigali is calculated for each sub-sector based upon the total capital stock reported in the Establishment Census. For instance, 21% of all financial & insurance sector firms enumerated are based in Kigali City, and these have a much

higher average capital stock than finance & insurance firms based outside Kigali. As a result, Kigali City receives a 38.2% weighting for the finance & insurance sector, or RWF 35.2 billion of the total RWF 92.2 billion for the sector in 2010.

The below table indicates that the output of Kigali City is approximately RWF 1,266

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billion (around US\$ 2.1 billion), taking a 41.0% share of GDP¹. Services account for 62% of Kigali's GDP compared to 48.5% nationally. Agriculture accounts for just 5.5% of Kigali's GDP.

ISSUES AND ASSUMPTIONS:

- Using capital shares to construct weights gives an upper bound estimate for Kigali's output if there are diminishing returns to capital and Kigali is assumed to have higher-than-average capital stocks;
- It is assumed that economic activity not captured by the Establishment Census is equally distributed across provinces this may not be entirely realistic but is likely to be concentrated in micro-scale informal economic activities that have a minimal

EMPLOYMENT IN KIGALI CITY

The best source of employment data comes from the EICV3 household survey, and this is available disaggregated to the provincial level (and, occasionally, the district level). Unfortunately data on employment by sector (according to ISIC coding) will not be available until May 2012 due to data cleaning and verifying. Nonetheless, data on population, workforce and occupation is available.

Kigali City now has a population of 1.06 million, which represents 3.01% growth per annum since 2005/06. This is around 0.2 million lower than in the population projections produced in 2009. There are now around 487,100 employed workers in Kigali City.

Despite data limitations, an estimation of employment by sector for 2010 has been made based upon growth in off-farm employment between 2005 and 2010 in

Table 8: Output by Sector, Kigali and Rwanda, RWF billion (current prices), 2010

	KIGALI WEIGHT	RWANDA GDP, 2010	KIGALI GDP, 2010
AGRICULTURE, FORESTRY AND FISHING	6.1%	1,137.2	69.4
INDUSTRY	90.6%	455.5	412.7
MINING AND QUARRYING	64.4%	13.5	8.7
MANUFACTURING	88.0%	195.0	171.6
UTILITIES	66.2%	7.7	5.1
CONSTRUCTION	95.0%	238.2	226.3
SERVICES	52.3%	1,497.7	783.8
WHOLESALE AND RETAIL TRADE	58.5%	414.9	242.6
TRANSPORTATION, STORAGE & ICT	70.9%	275.1	195.0
Accommodation and food services	16.7%	62.4	10.4
FINANCIAL AND INSURANCE ACTIVITIES	38.2%	92.2	35.2
REAL ESTATE ACTIVITIES, BUSINESS SERVICES	63.6%	220.6	140.4
PROFESSIONALS, SCIENTIFIC AND TECHNICAL	62.7%	165.1	103.6
EDUCATION & HEALTH	14.5%	230.5	33.5
OTHER SERVICES ACTIVITIES	39.0%	54.3	21.2
TOTAL (RWF BILLION)	41.0%	3,090.4	1,265.9

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

Table 9: Population and Population Density by Kigali Districts, 2010/11

	POPULATION NUMBER	DENSITY			
GASABO	476,244	1,110			
Кісикіго	301,216	1,807			
NYARUGENGE	282,290	2,107			
KIGALI CITY	1,059,750	1,452			
% Rwanda	9.8%	341.5%			
Source-Establishment Census 2011 (NISR_MINICOM_MIEOTRA and PSE)					

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

Table 10: Employment by Sector, Kigali City, 2005-2010

	2005	2010	GROWTH (P/A)
WORKFORCE	388,700	487,100	4.6%
OFF-FARM EMPLOYMENT	280,253	373,606	5.9%
AGRICULTURE	108,447	113,494	0.9%
INDUSTRY	43,764	69,667⁵	9.7%
Services	236,489	303,939⁵	5.1%

Source: Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)



Figure 7: Main Employment Activity of Workforce, Kigali City, 2010/11 Source: Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF).

¹ Excluding adjustments (e.g. Imputed bank service charge, VAT)

Kigali, which measured 5.9% per annum on average, as well as sector growth in terms of output. Off-farm employment in 2010 was around 373,606 compared to 280,253 in 2005. This is from a total workforce of 487,100 in 2010.

The estimations based upon total off-farm employment growth and sector output growth give figures of 69,667 jobs in industry and 303,939 in services.

SUB-SECTOR EMPLOYMENT

Further disaggregation of off-farm employment by sub-sector provides challenges due to the aforementioned data issues, however the Establishment Census 2011 can be used alongside the Household Survey data (EICV3) for 2010 to provide estimates. In much the same way that the Kigali's share of the total capital stock for a particular sub-sector (from the Establishment Census) was used to construct output weights for Kigali, the employment share for key sub-sectors will be used to project in the same manner.

The reason for the Establishment Census not capturing all employment is due to the level of unrecorded off-farm employment, and this is particularly high in the construction sector for instance. It is therefore assumed that the ratio of formal to informal/unrecorded employment in Kigali's construction sector is approximately the same as outside Kigali.

Table 11: Employment by Sub-Sector, Kigali City, 2010

SUB-SECTOR	Rwanda	KIGALI WEIGHT	Kigali
CONSTRUCTION	105,611	56.3%	59,480
Manufacturing	128,458	23.2%	29,802
Transport & communi- cation (incl. ICT)	105,898	61.7%	65,339
Finance & Insurance	23,651	39.1%	9.248

Source:Establishment Census 2011 (NISR, MINICOM, MIFOTRA and PSF)

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Rwanda: Projections

NATIONAL-LEVEL FORECASTING

METHODOLOGY

In order to forecast the evolution of GDP in Rwanda over the long run, an economic growth model is constructed in line with established economic theory and a large literature of similar studies². Specifically, a Solow growth model with two factor inputs, capital and quality-adjusted labour, is used. Long-term growth is determined by four key elements of the model, namely:

- Growth in the capital stock, determined by gross capital formation and the rate of depreciation
- Growth in the labour force
- Growth in the quality of labour (based upon the current and projected level of education)
- Growth in technological progress, which affects total factor productivity.

In turn, the evolution of these factors is based upon a number of assumptions derived from recent trends in performance, international market conditions, existing projections and additional expectations drawn from recent and planned government policy, investment agreements and so on. Assumptions are discussed further below for each key element of the model.

Sector level growth is determined by (a) gross capital formation and (b) labour demand, which are assumed to have a heterogeneous effect across sectors. Strong investment in capital and a growing stock of skilled labour will drive a shift towards industry and services for instance, as well as, in turn, affecting future growth of both

factors.

Note: Short-run economic forecasting at the national level is conducted by MINECOFIN in collaboration with NISR and IMF. Wherever possible, the consultant has used these projections to calibrate the growth model utilised.

NATIONAL OUTPUT, 2011-2040

Projections for Rwandan GDP and key input variables from 2011 to 2040 and are presented below in Rwandan Francs at constant 2010 prices. The first table presents the key projections for GDP as well as GDP per capita and growth of both indicators for the medium run, namely 2011-2020. The second provides longerterm projections from 2020 to 2040.

The tables above show that Rwanda is projected to continue the strong growth experienced over the last decade, where 7.4% growth was recorded, with growth of 7.5-8.5% per annum over the next 10 years. Afterwards, growth is projected to stabilise around 7% per annum. Average GDP per capita will increase to RWF 509,204 (approx. US\$ 850) by 2020 from a baseline of RWF 304,519 (US\$ 508) in 2010.

The key assumptions regarding input variables are described below:

Table 12: Projected Gross Domestic Product (GDP), Rwanda, 2011-20

	2011	2012	2013	2014	2015	2020
GDP (RWF BN.)	3,543	3,837	4,146	4,488	4,846	6,918
Average growth (p/a)	8.1%	8.3%	8.0%	8.3%	8.0%	7.4%
GDP PER CAPITA (RWF)	321,498	340,069	358,815	379,457	400,385	509,205
Average growth (p/a)	5.6%	5.8%	5.5%	5.8%	5.5%	4.9%

Table 13: Projected Gross Domestic Product (GDP), Rwanda, 2020-40

	2020	2025	2030	2035	2040
GDP (RWF BN.)	6,918	9,726	13,513	18,833	26,304
Average growth (p/a)	7.4%	7.1%	6.8%	6.9%	6.9%
GDP PER CAPITA (RWF)	509,205	647,002	816,530	1,036,314	1,321,286
Average growth (p/A)	4.9%	4.9%	4.8%	4.9%	5.0%



Figure 8: Gross Domestic Product (GDP), 2000-2040

² Solow (1956; 1957); Mankiw, Romer and

Weil (1992); Hall and Jones (1996)

CAPITAL STOCK

The capital stock in any given year is determined by the existing capital stock plus gross capital formation, minus depreciation of the existing stock. Depreciation is assumed to be constant at 5% in line with standard empirical estimates of 4-6%. The existing capital stock is calculated using estimates for 2000 projected forward to 2010 based on gross capital formation rates from MINECOFIN and the assumed depreciation rate (as per the Perpetual Inventory Method). Gross capital investment in 2010 was 21.3% of GDP, and is projected in the model to rise steadily to 24% by 2020 based on Vision 2020 targets and existing projections from MINECOFIN and the IMF.

After 2020, the gross capital stock is projected to stay constant at 24% GDP, in line with average rates for growing developing economies³, as a sustainable long-run rate of capital accumulation. In Rwanda's recent economic history, large public sector investments have led to sharp rises in gross capital formation, for example the Kigali Convention Centre (KCC) construction. Plans for the construction of an international airport in Bugesera District are considered from 2014 onwards in line with current projections from MINECOFIN and the IMF.

POPULATION AND WORKFORCE GROWTH

Rwanda's population grew at around 2.55% per annum between 2005 and 2010, dropping from 2.80 per annum growth in the previous 5 years (EICV3). As a result, projections made in 2009 have not been

met. For the purposes of this analysis, the original projections are adjusted in line with recently observed trends. The population is expected to grow at around 2.36% per annum over the next decade.

For workforce growth, projections of new entrants over the next 10 years are made according to (a) the current population of under 16s and recent trends, (b) estimated growth in enrolment rates for secondary and tertiary schools and (c) recent trends in the size of the economically inactive population. The workforce is expected to grow at roughly 2.20% per annum until 2020, although this rate will be faster at the beginning of the decade. This is due to falling birth rates and an expected surge in the number of students staying in education past the age of 16.

HUMAN CAPITAL

The average years of education of the population are used within the model to measure the level of human capital, or quality-adjusted labour, in line with Hall and Jones (1996). Diminishing returns to education are assumed as is commonly observed in empirical analyses. The average years of education in 2010 was 3.95 years, and had grown at an average rate of 1.83% between 2005 and 2010. Projections on the evolution of education levels is based upon previous growth trends adjusted for predicted increases in enrolment, particularly as the Government's 12 years of basic education (12YBE) programme (previously 9 YBE) starts to have effect. Reforms within education have a significant lag effect when it comes to the workforce, and this is taken into account in the model based on information from the demographic projections made alongside this report.



Figure 9: Sector Composition of GDP, 2000-2040

TECHNOLOGICAL PROGRESS

Total Factor Productivity (TFP) accounts for the effect of other not-described factors on output, such as institutional capacity, adaptability to latest technologies and so on. In the model used for this analysis, growth in TFP (i.e. technological progress) is assumed to gradually increase from the observed average of the last decade of around 2% to around 3.5% in the long run, allowing for some 'catch up' with the developed world. Technological progress is commonly estimated at 2% in similar studies, and the catch-up effect has been estimated at anything between an additional 0.5 and 1.5% based upon a range of factors⁴. This assumption is tested for robustness in the sensitivity analysis section of this report (to be completed).

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³ Hawksworth (2006), 'The World in 2050', PriceWaterhouseCoopers

⁴ Hawksworth (2006), 'The World in 2050',

SECTOR COMPOSITION OF OUTPUT, 2011-2040

Growth in sectors is determined by both demand-side and supply-side factors. On the demand side, the rate of return for a particular industry is a factor of previous growth in the sector and the capacity for further growth, in part affected by the projected pace of technological progress (growth in TFP). It is also facilitated by supply-side factors such as the skill level of the workforce. Based on these factors and existing estimates of sector growth and the composition of GDP, projections for agriculture, industry and service sector growth are illustrated in the below figure.

The industrial and service sectors will continue to eat into agriculture's share of GDP over the coming decades, with this structural transformation having significant implications for employment and urban areas such as Kigali City, discussed in the following sections. Vision 2020 and Rwanda's Industrial Policy target an increase in the share of industry in GDP from around 15% in 2010 to 25% by 2020. The projections made here are broadly in line with this goal, estimating that industry

will contribute 22.1% of output by 2020 and 28.3% by 2040. An increasing share of students enrolling in technical and vocational training will have positive effects on the stock of available labour for both industry and services, and will increase worker productivity.

SUB-SECTOR TRENDS

The construction sector has been a key driver of industrial growth over the last decade and this is expected to continue at least in the short term, but is likely to slow after 2020. Manufacturing of agricultural inputs as (agro-processing) and industrial inputs (e.g. cement) are expected to increase significantly in the short to medium term. The service sector will continue to expand with the finance & insurance sector playing a pivotal role, although the recent growth in employment in the education and health sectors is expected to slow due to budgetary constraints.

2031-35

4.4%

7.6%

7.4%

6.86%

2036-40

4.4%

7.4%

7.4%

6.91%





Figure 11: Employment Growth by Sector, 2005-2040

Table 14: Growth by Sector, 2011-2040

AGRICULTURE

INDUSTRY

SERVICES

TOTAL GDP

2011-15

6.2%

12.1%

8.7%

8.1%

2016-20

3.3%

12.5%

7.9%

7.4%

2021-25

3.8%

9.7%

7.5%

7.05%

2026-30

4.0%

8.2%

7.3%

6.80%

													_	
													_	
2032	2033	2024	1000 1000	_ C2U2	2036	2037		2038	2039		2040	T		
rvi	ce	s												
_													_	_
										_	1		'	1
2032	2033	2034	2035		2020	2037	2038		2039	0100	0#07			
rv	ice	s												

NATIONAL EMPLOYMENT, 2011-2040

Aside from sector level output trends, employment by sector is a key indicator built into the economic projections. Employment is partially endogenous to output, because sectors require available labour with the right skillset at an acceptable price (wage) as an input to production. Employment by sector is therefore determined as a function of sector output from the demand-side and also by the level of education on the supply-side, which is assumed to play a role in promoting off-farm employment.

Employment in agriculture will continue to drop, in line with rising productivity of the sector and land scarcity creating a surplus of labour and increasing levels of education. Furthermore, strong growth in the industry and service sectors will boost off-farm employment in these areas, particularly in manufacturing, finance and construction. An increase in the proportion of those over 16 years attending further education will slow growth in the workforce along with declining birth rates.

By 2020, approximately 50% of jobs will be in agriculture compared to 72% in 2010 and 90% in 2000. This fits with the Vision 2020 target of 50% off-farm jobs. By 2040, it is projected that the share of agriculture in employment will fall to around one third, with the remaining two thirds being made up of industry at 24% and services at 43%.



Figure 12: Sector Composition of Employment, 2005-2040

Table 15: Employment by Sector, 2011-2040

	2011	2015	2020	2025	2030	2040
AGRICULTURE	3,530,216	3,447,585	3,165,676	3,125,397	3,049,140	2,934,589
AVERAGE GROWTH (P/A)	-2.1%	-0.6%	-1.7%	-0.3%	-0.5%	-0.4%
INDUSTRY	314,629	552,178	990,058	1,308,304	1,585,813	2,103,948
AVERAGE GROWTH (P/A)	16.5%	11.9%	12.4%	5.7%	3.9%	5.8%
SERVICES	1,270,580	1,701,185	2,175,617	2,481,500	2,828,617	3,752,816
Average growth (p/a)	9.7%	6.0%	5.0%	2.7%	2.7%	5.8%
TOTAL EMPLOYMENT	5,090,876	5,700,947	6,331,351	6,915,201	7,463,571	8,791,354
Average growth (p/a)	2.1%	2.9%	2.1%	1.8%	1.5%	1.7%

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

National Economy: Sensitivity Analysis

An integral part of the forecasting, given the level of uncertainty that projecting 10 to 30 years ahead based upon non-perfect data generates, is the sensitivity analysis. This, for key input variables, measures the degree of variation in expected outcomes. Firstly, best- and worst-case scenarios for the key input variables of labour, capital and human capital are used to construct upper and lower bounds for overall GDP and employment. Secondly, variability of key output variables for individual inputs are measured, ceteris paribus.

GENERAL SENSITIVITY ANALYSIS

FACTORS

- Population growth 20% higher/lower than projected growth rate year-on-year
- Capital stock growth 20% higher/lower than projected growth rate year-on-year
- Growth in average years of education 20% higher/lower than projected rate, year-on-year

GDP GROWTH

The above figure illustrates the variability in national output if the three key input factors of labour, physical capital and human capital grow by 20% less / more than in the original projections. For instance, if the population is expected to grow by 3% in a year, the low-case scenario will input 2.4% growth and the high-case scenario will input 3.6% growth. The resultant inputs are summarised in the below table.

The original, low and high projections for GDP and GDP per capita are presented in the below table for key milestone years:

EMPLOYMENT

For employment, an additional variation in inputs is considered. Given the lower / higher overall GDP experienced in each of the alternative scenarios, off-farm employment is expected to grow by 20% less or more than the original growth rate. This affects the extent to which urbanisation occurs and therefore the composition of employment across sectors. The table below indicates the employment level by sector by scenario.

If population and economic growth both exceed expectations, then service sector employment will see 1.0 million extra jobs created by 2020, and an additional 1.4 million jobs by 2040, compared to the original projection. There will be 0.6 million fewer agricultural jobs in 2020 and 1.0 million less by 2040 under this scenario.

If population and economic growth are both slower than expectations, then service sector employment will see 0.6 million

Table 17: Projected Gross Domestic Product (GDP) by Scenario, Rwanda, 2011-40

	2011	2020	2030	2040
GDP (RWF BN.)	3,543	6,918	13,513	26,304
LOW	3,528	6,545	11,988	21,731
HIGH	3,588	7,317	15,388	32,286
Average growth (p/a)	8.1%	7.7%	6.9%	6.9%
LOW	7.6%	7.1%	6.2%	6.1%
HIGH	8.6%	8.3%	7.7%	7.7%
GDP PER CAPITA (RWF)	321,498	509,205	816,530	1,321,286
LOW	321,629	504,720	789,258	1,236,529
HIGH	321,356	514,666	850,966	1,432,432
Average growth (p/a)	5.6%	5.3%	4.8%	4.9%
LOW	5.6%	5.2%	4.6%	4.6%
HIGH	5.5%	5.4%	5.2%	5.3%

Table 18: Employment ('000s) by Scenario, Rwanda, 2011-40

	2011	2020	2030	2040
AGRICULTURE	3,530	3,166	3,049	2,935
LOW	3,537	3,775	3,496	3,243
HIGH				
	3,524	1,892	1,896	1,897
INDUSTRY	315	990	1,586	2,104
LOW	308	710	1,206	1,630
HIGH	321			
		1,480	2,239	2,894
SERVICES	1,246	2,176	2,829	3,753
LOW	1,221	1,561	2,151	2,908
HIGH				
	1,270	3,257	3,990	5,136
TOTAL	5,091	6,331	7,464	8,791
LOW	5,068	6,043	6,850	7,782
HIGH				
	5,115	6,629	8,125	9,927



Figure 13: GDP Projections by Scenario, Rwanda, 2011-2040

Table 16: Inputs by Scenario, Rwanda, 2011-40

	2011	2020	2030	2040
POPULATION (MILLIONS)	11.02	13.59	16.55	19.91
LOW	10.97	12.97	15.20	17.62
HIGH	11.07	14.23	18.02	22.48
CAPITAL FORMATION (%)	21.6%	24.0%	24.0%	24.0%
LOW	21.5%	23.4%	23.4%	23.4%
HIGH	21.7%	24.6%	24.6%	24.6%
AVERAGE YRS OF EDUCATION	4.02	4.92	6.06	7.38
LOW	4.01	4.71	5.56	6.52
HIGH	4.04	5.14	6.59	8.35

fewer jobs created by 2020, and 0.8 million fewer by 2040, compared to the original projection. There will be 0.6 million more agricultural jobs in 2020 and 0.3 million more by 2040 under this scenario.

FACTOR SENSITIVITY ANALYSIS

The factor sensitivity analysis adjusts the expected growth in an input variable (Column 1 of Table 19) by 20% higher or lower than the originally projected yearon-year growth, to construct an upper and lower bound for the output. Exceptions include gross capital formation as well as workforce share of total population, where the annual rate is plus or minus 2 percentage points based on reasonable parameters of fluctuation, and depreciation (plus or minus 1 percentage point), which is estimated by existing literature at between 4 and 6% per annum. Column 2 and 3 indicate the percentage by which overall GDP will be higher or lower than the original projection in 2020 and in 2040.

The results show that the model is relatively more susceptible to changes in population growth and technological progress than other factors, with GDP up to 10% lower with population growth 20% slower than projected by 2040. If technological progress is 20% slower than expected, by 2040 GDP will be 13.5% lower than originally projected.

Variability in other factors, all others held constant, does not drastically affect the results of the model, although changes physical and human capital growth will inevitably see changes in overall output. If the investment rate (gross capital formation) is 2% lower than expected, GDP will be roughly 3% lower by 2020 and 4% by 2040. If average years of schooling increase by less than expected, GDP will be roughly 2% lower by 2020 and 7% lower by 2040. This is because the benefits of education are particularly long-term focused, and thus variations with time become more acute.

Table 19: GDP - Factor Sensitivity Analysis, Rwanda, 2020 and 2040

FACTOR	GDP 2020	GDP 2040
Population (+/- 20% of y-o-y growth)	-3.56% +3.62%	-10.35% +11.52%
GROSS CAPITAL FORMATION (+/- 2%)	-2.99% +2.90%	-4.02% +3.87%
Average Years of Schooling (+/- 20% of y-o-y growth)	-1.61% +1.70%	-7.12% +8.65%
TECHNOLOGICAL PROGRESS (+/- 20% OF Y-O-Y GROWTH)	-3.21% +3.31%	-13.48% +15.54%
DEPRECIATION (+/-1%)	-1.94% +2.00%	-3.42% +3.20%
WORKFORCE (+/- 2% OF POPULATION)	-3.74% +3.74%	-4.40% +4.38%

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

Kigali City: Projections

METHODOLOGY

Economic analysis of Kigali City as a unit is difficult due to data limitations and issues of intra-national trade. As such, analysis and projections of the City's economy will focus on the output of key sectors located within the province, and the corresponding workforce these sectors support.

The common approach to calculating and forecasting economic output for a particular region for particular sectors would be to build an input-output model (originally elaborated by Leontief), however this technique is not even used at the national level in Rwanda currently. An input-output model shows production by sector, e.g. agriculture, industry and services, and then looks at the interrelatedness between sectors. For instance, agro-processing (industry) requires inputs from the agricultural sector, and so coefficients are calculated to model this relationship. Strong data is also needed on external inflows and leakages to the economy from neighbouring regions or from the international economy. which cannot be collected.

Production data for Kigali firms is not readily available, but it is possible to estimate Kigali's share of GDP by subsector by marrying Establishment Census 2011 data to the national accounts. The weighting of Kigali's output within total GDP for Rwanda is constructed as per Section 3 of this report. This is based upon the capital stock reported by 123,526 firms for 2010, and approximates Kigali's share in output of subsectors. This approach is a strong proxy if:

• Diminishing returns to capital are not too acute, or firms in Kigali in a particular

sector have similar levels of capital to those outside Kigali. If not, the weights will be an upper bound to the real value;

• Economic activity not captured by the Establishment Census is distributed evenly across provinces;

On the first issue, firms in Kigali seem to have a higher stock of capital than those outside Kigali within the same industry. Having twice the level of capital does not necessarily mean the firm will produce twice as much, due to diminishing returns to capital. As such, the weights are adjusted down slightly to accommodate for this.

OUTPUT OF KIGALI CITY, 2011-2040

In 2010, Kigali output stood at RWF 1.266 billion, or 41% of total GDP. Based on the constructed weights and estimation from Section 3, Kigali contributed 5% of all agricultural production, 33% of industrial production and 62% of all output from the service sector.

The industrial sector is expected to grow strongly over the next decade; the construction industry will continue to boom in Kigali although rising costs of industrial inputs could taper growth. Availability of land remains an issue for the private sector, and the Special Economic Zone will be key in this regard. By 2020, 35% of Kigali's output will come from the industrial sector. Kigali-based industries will contribute around 80% of all industrial output, at RWF 1.2 billion. After 2020, growth in the sector will begin strong as productivity levels rise, and will then settle at around 8% growth per annum.

Growth in the service sector will be positively affected by increasing skill



Figure 14: Sector Composition of GDP, Kigali City, 2010-2040

Table 20: Growth by Sector, Kigali City, 2011-2040

	2011-15	2016-20	2021-25	2026-30	2031-35	2036-40
AGRICULTURE	3.4%	2.4%	1.5%	1.5%	2.0%	2.0%
INDUSTRY	7.8%	8.3%	9.2%	9.8%	8.2%	8.0%
SERVICES	7.6%	8.2%	10.2%	9.0%	8.1%	7.8%
TOTAL GDP	7.5%	8.0%	9.6%	9.1%	8.1%	7.8%

levels and the continued expansion of the finance and insurance market, which is still predominantly based within Kigali. Decentralisation of major banks and institutions will address this balance to a certain extent, but growth in the sector will be driven from Kigali. The sector will grow between 10 and 11% until 2020. The five or so years following this will experience strong growth as skill level improvements begin to be realised and increase productivity, followed by a long-term trend of around 8% growth in the sector.

To date industry has been highly concentrated in Kigali, although agroprocessing facilities outside of the capital will lead to a temporary reduction in the overall share in the medium term. Kigali's

0.14

0.12

0.1

contribution to agriculture is expected to decline significantly after 2015, as the city further urbanises, and will decline as a result of diminishing agricultural land after 2020.

Employment in Kigali City, 2011-40

Employment figures for Kigali City are available by sector for 2005, and are projected up to 2010 based upon overall trends in off-farm employment for Kigali and Rwanda as a whole, as well as growth rates of output by sector. Forwardlooking projections are based upon Kigali's projected expected output trends by sector, as well as input trends such as education and skills development, population



Figure 16: Employment by Sector Share, Kigali City, 2010-2040



Figure 17: Sector Employment growth, Kigali City, 2010-2040

Table 22: Employment by Sector, Kigali City, 2012-2040

	2012	2015	2020	2025	2030	2040
Agriculture	19,789	129,017	136,374	120,428	106,148	83,407
Average growth (p/a)	2.0%	2.2%	1.1%	-2.5%	-2.5%	-2.3%
INDUSTRY	19,189	157,032	232,451	317,093	399,077	559,736
Average growth (p/a)	10.4%	9.3%	8.2%	6.4%	4.7%	3.4%
SERVICES	20,383	395,123	541,057	758,480	964,562	1,319,985
Average growth (p/a)	7.7%	7.1%	6.5%	7.0%	4.9%	2.7%
TOTAL EMPLOYMENT	59,361	681,173	909,882	1,196,001	1,469,786	1,963,127



Figure 15: Sector GDP growth, Kigali City, 2010-2040

Table 21: Kigali's share within Rwanda, GDP by Sector, 2011-2040

	2010	2015	2020	2025	2030	2040
AGRICULTURE	5.5%	4.5%	3.5%	2.4%	1.6%	0.9%
INDUSTRY	32.6%	33.1%	33.6%	33.0%	34.0%	34.6%
SERVICES	61.9%	62.3%	63.0%	64.7%	64.4%	64.5%

growth, workforce growth and anticipated urbanisation.

The industrial sector will lead employment growth in Rwanda, as in output, with growth of 8-10% per annum for the next decade. Thereafter, growth in industrial employment will decline towards 4% per annum by 2030, with a long run growth rate of between 3 and 4% per annum. This will be driven initially by strong growth in the construction sector, as has been witnessed to date, along with an increasing share of manufacturing.

The service sector, set to also grow strongly in terms of output, will grow at a slower rate than industry initially in terms of employment but will benefit from significant improvements in productivity. Growth in service sector employment will average between 6 and 8% up until 2020, with a long run growth rate of around 3-4%. This compares to overall service sector output growth of around 8%.

The agricultural sector is expected to grow by around 2.5% a year in terms of Kigali City employment up 2018 when urbanisation will lead to a declining share of agriculture and a negative growth rate of around 2.5% per annum. EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

6.3% per annum over the next decade, more than double the national rate, as a result of urbanisation measured in population projections. As seen above, this growth will be almost entirely concentrated in off-farm employment, with the industrial sector, traditionally concentrated in the capital, playing a large role.

The total workforce in Kigali will grow by

Agricultural employment will decline as the shift from farm to off-farm employment continues, and the overall share of off-farm employment in Kigali will increase from 77% in 2010 to 81% by 2015, 85% by 2020 and 96% by 2040. In 2020, Kigali will contribute 55% of all off-farm employment compared to 27% currently, although other urban growth poles are expected to take advantage of growth in higher value-added sectors after this point so that Kigali's share declines to 32%.

SUB-SECTOR PROJECTIONS, 2011-2020

Projections of sub-sector employment from 2011 to 2020 are formed upon the baseline estimations of 2010 sub-sector employment indicated in Section 3 of the report. Furthermore, growth is projected forward in employment using overall growth in the industrial and service sectors for Kigali City (Table 18, above) as an underlying trend. Then, case specific details are added to the projections, for instance the construction of the Bugesera International Airport in 2014, 2015 and 2016 is expected to affect Kigali City's construction sector to a certain extent. The construction sector is expected to grow strongly in terms of employment during the next 5 to 10 years, and thereafter is expected to grow steadily at around the overall trend rate for industry.

Manufacturing employment, based upon plans of the National Industrial Policy, industrial turnaround plans, Gikondo industrial relocation plans and others is expected to grow at an increasing rate, with strong growth expected beyond 2016. This will at first be driven by traditional manufacturing, followed by an increasing and broadened level of agro-processing and production of industrial inputs.

It is expected that Kigali's share of industrial development will at first be significant, due to the high level of existing and planned infrastructure relative to other areas of the country. In the long run, other urban areas and proposed plans for Provincial Industrial Parks could encourage industrial development outside of Kigali City; however it is expected that the major drive of such initiatives will not be realised within the next 5 years and will only begin to have significant effects after 2020.

The service sector is projected to grow between 8 and 10% over the next decade, and this will in particular be driven by increases in the communications & ICT sector and finance & insurance. This is due to high projected growth in both sectors in terms of output, coupled with increasing focus on technical, vocational and tertiary education and training in these areas. Furthermore, these sectors are concentrated highly within Kigali City, and despite some level of decentralisation, growth in employment will be driven by the capital.



Figure 18: Sub-Sector Employment, Kigali City, 2010-2020

Table 23: Sub-Sector Employment, Kigali City, 2010-2020

('000s)	2012	2013	2014	2015	2020
CONSTRUCTION	74,170	83,220	94,881	107,808	156,127
Average growth (p/a)	12.6%	12.2%	14.0%	13.6%	7.7%
MANUFACTURING	32,514	34,693	37,272	40,314	70,464
Average growth (p/a)	7.1%	6.7%	7.4%	8.2%	11.8%
TRANSPORT, COMS. & ICT	83,586	92,616	101,084	109,385	149,785
Average growth (p/a)	13.1%	10.8%	9.1%	8.2%	6.5%
FINANCE & INSURANCE	12,394	14,666	17,263	20,345	42,570
Average growth (p/a)	18.5%	18.3%	17.7%	17.9%	15.9%

INCOME ANALYSIS, 2011-2040

The average income of a citizen in Kigali City will be driven by changes in overall national and provincial growth, and will vary among individuals according to skill level, sector of employment, age and numerous additional factors. This sub-section attempts to project the average income of residents of Kigali City based upon overall growth in the economy and factors specific to the capital. It particularly uses changes in the structure of Kigali's economy as factors for driving incomes upwards, such as the shift towards off-farm jobs.

It is important to note that the average income level of residents of Kigali City is not directly comparable to the City's output (projected above) divided by the total

Table 24: Average Income and Distribution, Kigali City, 2011-2040

	2011	2015	2020	2025	2030	2040
Average In- come (RWF)	657,840	847,077	1,077,518	1,395,185	1,766,641	2,587,925
< RWF 100к	0.4%	0.3%	0.2%	0.1%	0.1%	0.0%
RWF 100 - 200ĸ	3.1%	2.5%	1.8%	1.1%	0.7%	0.3%
RWF 200 - 400ĸ	14.4%	11.8%	9.1%	6.1%	4.4%	2.6%
RWF 400 - 600ĸ	13.6%	13.8%	15.1%	14.2%	15.1%	16.6%
RWF 600ĸ+	68.4%	71.6%	73.9%	78.5%	79.7%	80.5%
Average HH IN- COME (RWF)	3,110,984	3,684,784	4,363,948	5,650,500	7,154,894	9,187,134

population. This, as aforementioned, is due to the level of output and capital that flows through Kigali but may result from activities outside of the capital.

The table below indicates that the average income level is expected to reach RWF 1.1 million by 2020 (approx. \$1,850), and will increase steadily to around RWF 2.6 million by 2040. This compares to national GDP per capita of RWF 510,000 in 2020 and RWF 1.3 million in 2040.

No data is currently available on income above RWF 600,000 for 2010, and so illustrating the distribution of income at this level is not possible. The table above however does show that the share of those earning below RWF 400,000 per annum is expected to decrease steadily, with 89% earning above the RWF 400,000 threshold

by 2020 and 97% by 2040.

Average household income takes into account the changing demographical traits of the Kigali population, whereby the average household size will decrease from around 4.7 people in 2011 to 4.1 by 2020 and 3.6 by 2040 (from demographic projections). At the same time, the workforce as a percentage of the total population increases as the dependency ratio decreases, and this is reflected in the projections used throughout the model. The above table indicates that average household income will increase from RWF 3.1 million in 2011 to RWF 4.4 million by 2020, and RWF 9.2 million by 2040.

Kigali's projected output over time is directly linked to the model used at the national level. The sensitivity analysis conducted in Section 5 of the report and the results produced can be assumed to be the same for Kigali City, as the change in input factors does not directly affect the share of output that Kigali holds relative to the rest of Rwanda.

Therefore changes in the national population, investment rate, educational improvements and technological progress affect Kigali to the same extent as the economy as a whole. The sensitivity analysis within this section therefore focuses on Kigali specific factors, particularly population and workforce growth but also the expected growth of individual sectors. This is conducted for to output variables: GDP and employment.

GDP

GENERAL SENSITIVITY ANALYSIS

- Kigali population as per demographic projections
- National GDP as per Section 5

GDP SENSITIVITY

The above figure indicates the upper and lower bounds for Kigali's GDP based upon national GDP bounds from Section 5, and variable population growth as per demographic projections. Kigali's GDP ranges from a minimum of RWF 3.17 billion to a maximum of RWF 3.56 billion in 2020, and a minimum of RWF 12.29 billion and a maximum of RWF 21.28 billion in 2040. This large divergence in the longest projection indicates the susceptibility of results to less than expected overall GDP growth.

FACTOR SENSITIVITY ANALYSIS

The above factor sensitivity analysis indicates that variations in population or sector level growth can have a significant effect on overall GDP. Population projections give reasonably different scenarios for the population in 2040, and this accordingly affects GDP.

Lower or greater than expected growth in a particular sector affects overall GDP according to the projected share of output in 2040. For instance, the agricultural sector is expected to be very small in comparison to overall GDP, and therefore over- or underperformance in the sector has little bearing on overall GDP. However, prolonged underperformance of the industrial sector can potentially reduce overall GDP by 15.8% by 2040 and the same in the service sector could lead to a 24.6% reduction, *ceteris paribus*.

The factor sensitivity analysis reveals

the importance of constructing a robust projection of real performance up to 2040, which the original projection made in Section 6 is considered to be.

EMPLOYMENT

For construction of lower and upper bounds to employment by sector, the impact of lower / higher overall GDP and off-farm employment is considered as per the estimations from Section 5. This captures different scenarios for the level of structural transformation away from agriculture and into industry and services, and relatedly the extent to which urbanisation occurs. The table below indicates the employment level by sector by scenario.

If population, economic growth and offfarm employment exceed expectations, then service sector employment in Kigali will see 80,000 extra jobs created by 2020, and an additional 296,000 jobs by 2040, compared to the original projection. There will be 41,000 fewer agricultural jobs in 2020 and 41,000 again by 2040 under this scenario. In the industrial sector there will be 40,000 extra jobs by 2020 and 100,000 by 2040.

If population and economic growth are both slower than expectations, then service sector employment will see 19,000 fewer jobs by 2020, and 269,000 fewer by 2040, compared to the original projection. There will be 12,000 fewer agricultural jobs in 2020 and 8,000 less by 2040 under this scenario. In the industrial sector there will be 21,000 fewer jobs by 2020 and 55,000 by 2040. **EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013**

Key Variable Trends, Rwanda (2000-2040)	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables													
GDP (RWF bn.)	1,594	2,328	3,277	3,543	3,837	4,146	4,488	4,846	6,918	9,726	13,513	18,833	26,304
Average growth (p/a)		7.9%	7.1%	8.1%	8.3%	8.0%	8.3%	8.0%	7.4%	7.1%	6.8%	6.9%	6.9%
GDP per capita	192,859	245,241	304,519	321,498	340,069	358,815	379,457	400,385	509,205	647,002	816,530	1,036,314	1,321,286
Average growth (p/a)		4.9%	4.4%	5.6%	5.8%	5.5%	5.8%	5.5%	4.9%	4.9%	4.8%	4.9%	5.0%
GDP per worker	419,336	515,817	654,048	695,884	734,491	773,308	810,807	850,074	1,092,714	1,406,525	1,810,489	2,329,114	2,991,995
Average growth (p/a)		4.2%	4.9%	6.4%	5.5%	5.3%	4.8%	4.8%	5.2%	5.2%	5.2%	5.2%	5.1%
Input Variables													
Gross Capital Formation (% GDP)	13.7%	14.8%	21.3%	21.6%	21.6%	21.6%	21.6%	21.9%	24.0%	24.0%	24.0%	24.0%	24.0%
Population (millions)	8.27	9.49	10.76	11.02	11.28	11.55	11.83	12.10	13.59	15.03	16.55	18.17	19.91
Average growth (p/a)		2.80%	2.55%	2.39%	2.40%	2.39%	2.37%	2.34%	2.34%	2.04%	1.94%	1.89%	1.84%
Workforce (millions)	3.80	4.51	5.01	5.09	5.22	5.36	5.54	5.70	6.33	6.92	7.46	8.09	8.79
Average growth (p/a)		3.5%	2.1%	1.6%	1.9%	2.0%	2.1%	2.2%	2.1%	1.8%	1.5%	1.6%	1.7%
Average years of education	3.175	3.606	3.949	4.021	4.098	4.180	4.267	4.361	4.920	5.485	6.056	6.687	7.383
Average growth (p/a)		2.6%	1.8%	1.8%	1.9%	2.0%	2.1%	2.2%	2.4%	2.2%	2.0%	2.0%	2.0%
Sector Trends, Rwanda (2000-2040	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)													
Agriculture	47.2	43.1	36.8	36.3	35.7	34.9	34.2	33.3	27.4	23.5	20.6	18.3	16.2
Industry	13.0	14.2	14.7	15.4	15.8	16.3	16.8	17.5	22.1	25.0	26.6	27.6	28.3
Services	39.8	42.7	48.5	48.3	48.5	48.8	49.0	49.3	50.5	51.5	52.8	54.2	55.5
Average Growth (% p/a)		7.86%	7.08%	8.10%	8.32%	8.03%	8.26%	7.98%	7.4%	7.05%	6.80%	6.86%	6.91%
Agriculture		6.0%	8.9%	7.5%	6.4%	5.9%	6.0%	5.1%	3.3%	3.8%	4.0%	4.4%	4.4%
Industry		9.8%	9.0%	14.2%	11.0%	11.3%	11.5%	12.3%	12.5%	9.7%	8.2%	7.6%	7.4%
Services		9.5%	11.1%	8.6%	8.9%	8.6%	8.8%	8.5%	7.9%	7.5%	7.3%	7.4%	7.4%
Employment ('000s)	3,628	4,512	5,011	5,091	5,224	5,361	5,535	5,701	6,331	6,915	7,464	8,086	8,791
Agriculture	3,264	3,450	3,605	3,530	3,501	3,467	3,464	3,448	3,166	3,125	3,049	2,986	2,935
Industry	61	168	270	315	365	421	483	552	990	1,308	1,586	1,832	2,104
Services	346	723	1,136	1,246	1,359	1,473	1,588	1,701	2,176	2,482	2,829	3,268	3,753

KIGALI CITY PROJECTIONS: MEDIUM CASE SCENARIO

Key Variable Trends, Kigali (2011-2040)	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables		·	<u>.</u>	·				·	·	
GDP (RWF bn.)	1,392	1,532	1,684	1,852	2,038	3,351	5,206	7,905	11,725	16,784
Average growth (p/a)		10.0%	9.9%	10.0%	10.1%	10.5%	9.2%	8.7%	8.2%	7.4%
GDP per capita	1,230,285	1,268,098	1,307,102	1,350,865	1,400,149	1,716,317	2,050,353	2,506,331	3,138,655	3,932,792
Average growth (p/a)		3.1%	3.1%	3.3%	3.6%	4.2%	3.6%	4.1%	4.6%	4.6%
Input Variables		<u>`</u>								
Population ('000s)	1,132	1,208	1,288	1,371	1,455	1,953	2,539	3,154	3,736	4,268
Average growth (p/a)		6.7%	6.6%	6.4%	6.2%	6.1%	5.4%	4.4%	3.4%	2.7%
Workforce ('000s)	523	559	598	639	681	910	1,196	1,470	1,722	1,963
Average growth (p/a)		7.0%	6.9%	6.9%	6.6%	6.0%	5.6%	4.2%	3.2%	2.7%

Sector Trends, Kigali (2010-2040)	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)											
Agriculture	5.5	5.2	4.8	4.5	4.2	3.9	2.7	1.9	1.4	1.0	0.8
Industry	32.6	33.0	33.3	33.7	34.0	34.3	35.4	36.3	36.5	36.4	37.2
Services	61.9	61.9	61.9	61.8	61.7	61.7	61.8	61.7	62.1	62.5	61.9
Average Growth (% p/a)	4.6%	10.0%	10.0%	9.9%	10.0%	10.1%	10.4%	8.7%	8.8%	7.7%	7.1%
Agriculture	0.9%	3.6%	2.8%	2.5%	3.1%	2.9%	1.9%	1.9%	2.1%	2.3%	1.8%
Industry	17.4%	11.2%	11.2%	11.3%	11.0%	11.0%	10.7%	9.3%	8.6%	8.0%	7.9%
Services	3.1%	9.9%	10.0%	9.7%	9.9%	10.0%	10.5%	8.5%	9.0%	7.7%	6.8%
Employment ('000s)	487	523	559	598	639	681	910	1,196	1,470	1,722	1,963
Agriculture	113	117	120	122	126	129	136	120	106	94	83
Industry	97	108	119	131	144	157	232	317	399	474	560
Services	276	297	320	345	369	395	541	758	965	1,154	1,320

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

Key Variari e Trends													
RWANDA (2000-2040)	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables													
GDP (RWF bn.)	1,594	2,328	3,277	3,528	3,804	4,090	4,405	4,732	6,545	8,903	11,973	16,130	21,731
Average growth (p/a)		7.9%	7.1%	7.6%	7.8%	7.5%	7.7%	7.4%	6.7%	6.3%	6.1%	6.1%	6.1%
GDP per capita	192,859	245,241	304,519	321,635	340,268	358,986	379,500	400,134	504,517	632,818	787,954	984,746	1,233,223
Average growth (p/a)		4.9%	4.4%	5.6%	5.8%	5.5%	5.7%	5.4%	4.7%	4.6%	4.5%	4.6%	4.6%
GDP per worker	419,336	515,817	654,048	696,179	734,920	773,676	810,898	849,541	1,082,654	1,375,692	1,747,126	2,213,215	2,792,580
Average growth (p/a)		4.2%	4.9%	6.4%	5.6%	5.3%	4.8%	4.8%	5.0%	4.9%	4.9%	4.8%	4.8%
Input Variables													
Gross Capital Formation (% GDP)	13.7%	14.8%	21.3%	21.5%	21.5%	21.5%	21.5%	21.7%	23.4%	23.4%	23.4%	23.4%	23.4%
Population (millions)	8.27	9.49	10.76	10.97	11.18	11.39	11.61	11.83	12.97	14.07	15.20	16.38	17.62
Average growth (p/a)		2.80%	2.55%	1.91%	1.92%	1.91%	1.90%	1.87%	1.87%	1.64%	1.55%	1.51%	1.47%
Workforce (millions)	3.80	4.51	5.01	5.07	5.18	5.29	5.43	5.57	6.05	6.47	6.85	7.29	7.78
Average growth (p/a)		3.5%	2.1%	1.13%	2.14%	2.13%	2.77%	2.53%	1.65%	1.37%	1.15%	1.24%	1.32%
Average years of education	3.175	3.606	3.949	4.007	4.068	4.133	4.202	4.276	4.710	5.139	5.564	6.024	6.521
Average growth (p/a)		2.6%	1.8%	1.46%	1.52%	1.60%	1.68%	1.76%	1.95%	1.76%	1.60%	1.60%	1.60%
		1	1		1	1		1	1	1	1	1	
Sector Trends, Rwanda (2000-2040	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)													
Agriculture	47.2	43.1	36.8	36.3	35.7	34.9	34.2	33.3	27.4	23.5	20.6	18.3	16.2
Industry	13.0	14.2	14.7	15.4	15.8	16.3	16.8	17.5	22.1	25.0	26.6	27.6	28.3
Services	39.8	42.7	48.5	48.3	48.5	48.8	49.0	49.3	50.5	51.5	52.8	54.2	55.5
Average Growth (% p/a)		7.86%	7.08%	7.64%	7.82%	7.52%	7.72%	7.41%	6.7%	6.35%	6.10%	6.14%	6.14%
Agriculture		6.0%	8.9%	7.1%	6.0%	5.4%	5.5%	4.5%	2.7%	3.1%	3.3%	3.7%	3.6%
Industry		9.8%	9.0%	13.7%	10.5%	10.7%	11.0%	11.7%	11.8%	9.0%	7.5%	6.9%	6.7%
Services		9.5%	11.1%	8.2%	8.4%	8.1%	8.3%	7.9%	7.2%	6.8%	6.6%	6.7%	6.7%
Employment ('000s)	3,628	4,512	5,011	5,067	5,176	5,286	5,433	5,570	6,046	6,472	6,853	7,288	7,782
Agriculture	3,264	3,450	3,605	3,537	3,545	3,556	3,607	3,653	3,775	3,652	3,496	3,361	3,243
Industry	61	168	270	308	345	384	426	470	710	973	1,206	1,411	1,630
Services	346	723	1,136	1,221	1,286	1,345	1,400	1,447	1,561	1,846	2,151	2,517	2,908

KIGALI CITY PROJECTIONS: LOW CASE SCENARIO

Key Variable Trends, Kigali (2011-2040)	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables										
GDP (RWF bn.)	1,388	1,522	1,667	1,826	2,000	3,168	4,761	6,988	9,683	12,285
Average growth (p/a)		9.7%	9.5%	9.5%	9.5%	9.6%	8.5%	8.0%	6.7%	4.9%
GDP per capita	1,224,191	1,256,545	1,290,693	1,330,363	1,375,709	1,664,116	2,003,583	2,476,832	3,010,478	3,465,589
Average growth (p/a)		2.6%	2.7%	3.1%	3.4%	3.9%	3.8%	4.3%	4.0%	2.9%
Input Variables	•					•	·			
Population ('000s)	1,134	1,212	1,291	1,372	1,454	1,904	2,376	2,821	3,217	3,545
Average growth (p/a)		6.8%	6.6%	6.3%	5.9%	5.5%	4.5%	3.5%	2.7%	2.0%
Workforce ('000s)	524	561	599	640	680	887	1,119	1,315	1,483	1,631
Average growth (p/a)		7.1%	6.8%	6.7%	6.4%	5.5%	4.8%	3.3%	2.4%	1.9%

Sector Trends, Kigali (2010-2040)	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)											
Agriculture	3.1	5.2	4.9	4.5	4.3	4.0	2.5	1.8	1.3	1.0	0.9
Industry	36.1	33.0	33.3	33.8	34.1	34.4	36.1	36.9	36.9	37.8	41.8
Services	24.3	61.8	61.8	61.7	61.6	61.6	61.4	61.4	61.8	61.2	57.3
Average Growth (% p/a)	4.6%	9.7%	9.7%	9.5%	9.5%	9.5%	9.1%	7.9%	8.0%	5.3%	4.5%
Agriculture	0.9%	3.8%	2.8%	2.3%	2.7%	2.2%	2.1%	1.5%	1.8%	1.6%	1.1%
Industry	17.4%	10.9%	10.8%	11.0%	10.6%	10.6%	10.2%	8.5%	7.8%	7.1%	7.0%
Services	3.1%	9.5%	9.6%	9.3%	9.4%	9.4%	9.1%	7.8%	8.3%	4.2%	2.8%
Employment ('000s)	487	524	561	599	640	680	887	1,119	1,315	1,483	1,631
Agriculture	113	116	123	121	121	123	124	108	99	87	75
Industry	97	107	127	138	158	163	221	287	364	418	505
Services	276	296	311	330	361	392	532	724	852	912	1,051

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

Key Variable Trends, Rwanda (2000-2040)	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables		- -		,								-`	
GDP (RWF bn.)	1,594	2,328	3,277	3,558	3,871	4,202	4,572	4,964	7,318	10,646	15,305	22,123	32,144
Average growth (p/a)		7.9%	7.1%	8.6%	8.8%	8.6%	8.8%	8.6%	8.1%	7.8%	7.5%	7.6%	7.8%
GDP per capita	192,859	245,241	304,519	321,364	339,879	358,662	379,448	400,695	514,388	662,960	849,521	1,097,714	1,429,910
Average growth (p/a)		4.9%	4.4%	5.5%	5.8%	5.5%	5.8%	5.6%	5.1%	5.2%	5.1%	5.3%	5.4%
GDP per worker	419,336	515,817	654,048	695,593	734,080	772,979	810,787	850,74	1,103,838	1,441,217	1,883,639	2,467,110	3,237,969
Average growth (p/a)		4.2%	4.9%	6.4%	5.5%	5.3%	4.9%	4.9%	5.3%	5.5%	5.5%	5.5%	5.6%
Input Variables													
Gross Capital Formation (% GDP)	13.7%	14.8%	21.3%	21.7%	21.7%	21.7%	21.7%	22.0%	24.6%	24.6%	24.6%	24.6%	24.6%
Population (millions)	8.27	9.49	10.76	11.07	11.39	11.72	12.05	12.39	14.23	16.06	18.02	20.15	22.48
Average growth (p/a)		2.80%	2.55%	2.87%	2.88%	2.87%	2.84%	2.81%	2.81%	2.45%	2.33%	2.27%	2.21%
Workforce (millions)	3.80	4.51	5.01	5.11	5.27	5.44	5.64	5.83	6.63	7.39	8.13	8.97	9.93
Average growth (p/a)		3.5%	2.1%	2.07%	3.10%	3.09%	3.73%	3.47%	2.59%	2.19%	1.92%	1.99%	2.05%
Average years of education	3.175	3.606	3.949	4.036	4.128	4.227	4.333	4.448	5.138	5.853	6.590	7.420	8.354
Average growth (p/a)		2.6%	1.8%	2.20%	2.28%	2.40%	2.52%	2.64%	2.93%	2.64%	2.40%	2.40%	2.40%
Sector Trends, Rwanda (2000-2040	2000	2005	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)													
Agriculture	47.2	43.1	36.8	36.3	35.7	34.9	34.2	33.3	27.4	23.5	20.6	18.3	16.2
Industry	13.0	14.2	14.7	15.4	15.8	16.3	16.8	17.5	22.1	25.0	26.6	27.6	28.3
Services	39.8	42.7	48.5	48.3	48.5	48.8	49.0	49.3	50.5	51.5	52.8	54.2	55.5
Average Growth (% p/a)		7.86%	7.08%	8.56%	8.81%	8.55%	8.80%	8.56%	8.1%	7.79%	7.53%	7.65%	7.76%
Agriculture		6.0%	8.9%	8.0%	6.9%	6.4%	6.5%	5.7%	4.0%	4.5%	4.7%	5.1%	5.2%
Industry		9.8%	9.0%	14.7%	11.5%	11.8%	12.1%	12.9%	13.3%	10.5%	8.9%	8.4%	8.3%
Services		9.5%	11.1%	9.1%	9.4%	9.1%	9.3%	9.1%	8.6%	8.2%	8.1%	8.2%	8.3%
Employment ('000s)	3,628	4,512	5,011	5,115	5,273	5,436	5,639	5,835	6,629	7,387	8,125	8,967	9,927
Agriculture	3,264	3,450	3,605	3,524	3,440	3,336	3,245	3,118	1,892	1,906	1,896	1,893	1,897
Industry	61	168	270	321	388	467	559	666	1,480	1,892	2,239	2,545	2,894
Services	346	723	1,136	1,270	1,445	1,633	1,836	2,051	3,257	3,588	3,990	4,529	5,136

KIGALI CITY PROJECTIONS: HIGH CASE SCENARIO

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Key Variable Trends, Kigali (2011-2040)	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Output Variables										
GDP (RWF bn.)	1,397	1,543	1,704	1,882	2,082	3,561	5,721	8,995	14,071	21,284
Average growth (p/a)		10.5%	10.4%	10.5%	10.6%	11.3%	9.9%	9.5%	9.4%	8.6%
GDP per capita	1,228,225	1,262,534	1,296,865	1,334,773	1,377,965	1,678,576	1,982,058	2,431,451	3,167,350	4,192,148
Average growth (p/a)		2.8%	2.7%	2.9%	3.2%	4.0%	3.4%	4.2%	5.4%	5.8%
Input Variables										
Population ('000s)	1,138	1,222	1,314	1,410	1,511	2,122	2,886	3,699	4,442	5,077
Average growth (p/a)		7.5%	7.5%	7.3%	7.2%	7.0%	6.4%	5.1%	3.7%	2.7%
Workforce ('000s)	526	566	610	657	707	989	1,360	1,724	2,048	2,336
Average growth (p/a)		7.7%	7.7%	7.8%	7.6%	6.9%	6.6%	4.9%	3.5%	2.7%

Sector Trends, Kigali (2010-2040)	2010	2011	2012	2013	2014	2015	2020	2025	2030	2035	2040
Share of GDP (%)											
Agriculture	5.5	5.2	4.9	4.6	4.4	4.2	3.3	2.3	1.7	1.2	0.9
Industry	32.6	32.9	33.3	33.6	33.9	34.1	34.6	35.7	36.1	35.6	36.1
Services	61.9	61.9	61.9	61.7	61.7	61.7	62.1	62.0	62.3	63.2	62.9
Average Growth (% p/a)	0.0%	10.4%	10.5%	10.4%	10.5%	10.6%	11.7%	9.4%	9.6%	9.3%	8.1%
Agriculture	0.0%	4.5%	4.0%	4.0%	4.8%	5.2%	9.0%	2.3%	2.5%	3.1%	2.7%
Industry	0.0%	11.5%	11.5%	11.7%	11.3%	11.4%	11.3%	10.2%	9.6%	8.9%	9.0%
Services	0.0%	10.3%	10.4%	10.2%	10.4%	10.6%	12.1%	9.2%	9.8%	9.7%	7.6%
Employment ('000s)	487	526	566	610	657	707	998	1,360	1,724	2,048	2,336
Agriculture	113	116	116	103	103	101	95	92	87	65	42
Industry	97	109	126	143	164	167	272	308	499	546	670
Services	276	300	324	364	390	439	621	960	1,137	1,437	1,624

EXISTING CONDITIONS ANALYSIS & VISION REPORT- MAY 2013

SOCIO-DEMOGRAPHICS ANALYSIS OF KIGALI CITY 2010-2040

INTRODUCTION

This study explores the socio-demography of Kigali City. It examines key socioeconomic and demographic characteristics of society in the City for incorporation in the Existing Conditions and Vision Report in the development of the detailed master plan for Kicukiro and Gasabo districts, part of the Kigali City Master Plan. The approach used divides the study into three broad sections thus: the current status, future projections, and their implications.

METHODOLOGY

The study has relied to a large extent on data collected by the National Institute of Statistics of Rwanda (NISR), such as the Third Integrated Household Living Conditions Survey (EICV3, 2010), the Rwanda Demographic and Household Survey (RDHS 2010), the National Census (2002), as well as past studies of Kigali City, such as the Kigali City Master Plan (2007).

The national long-term strategy, Vision 2020, as well as its midterm counterpart, the Economic Development and Poverty Reduction Strategy (EDPRS), were also heavily consulted. Kigali City Council also provided data used in the analysis of the current status.

DEMOGRAPHY & POPULATION CHARACTERISTICS

Recent estimates place the population of Kigali City at approximately 1,059,000 (EICV3, 2011). That is 10% of the total Rwandan population of around 10,762,999. Administratively, the City comprises three districts: Gasabo, Kicukiro and Nyarugenge. Of these, Gasabo has the largest share of the population of Kigali City, at 44 percent. The remaining 56 percent of the population is shared equally between Kicukiro and Nyarugenge, around 28 percent each (RDHS 2010). As is the case with the Rwandan trends, more women than men inhabit Kigali City, 49 and 51 percent, respectively.

The population pyramid (see fig. 1.) shows the age structure of the population in Kigali City conforming to national trends. Almost half of the population (48%) is aged 19 or younger. Likewise, less than two (1.4) percent of the population in Kigali City is aged 65 and older.

The population structure for Kigali City, therefore, indicates a city with a young population – also not dissimilar nationally – with around to 87 percent of its residents below 40 years of age.

URBANIZATION RATE

Kigali City is the most urbanized of Rwanda's five administrative provinces (see fig. 2). According to the EICV (2011) survey around 84% of the population of Kigali City is categorized as urban dwellers, with only 16% living in rural residential areas.

Conversely, the rest of Rwanda has 85% of its population in rural residential areas and only 15% urban (EICV3, 2011).

As the nation's capital and therefore host to the most vibrant commercial center in the country, this comparatively high rate of urbanization is expected. Indeed, the urban lure makes Kigali City the fastest growing province in the country. Its population growth rate is 6.2% compared to 2.8% for the rest of the country (SPHD, 2006).

At the district level, the Strategic Plan for Health Development for Kigali (2006) showed Kicukiro as the fastest growth district at 7.5%; Gasabo and Nyarugenge were shown to grow at a rate of 6.4 and 4.4 %, respectively (fig 3 above, Kigali city population by district).



Fig. 2. Urbanization Rate for Rwanda Source: EICV3 2010/2011



Fig. 3. Urbanization Rate for Kigali City Source: EICV3 2010/2011



Fig. 1. Population Pyramid for Kigali City Source: EICV3 2010/2011



MIGRATION

Kigali City is most attractive for internal and international immigration. Over halve (54%) of these move to Kigali for employment related reasons compared the national average where only 39% have moved for similar reasons. According to the EICV3 (2011), "the direction of migration for internal migrants tends to grow towards the capital city," where over the past five years those migrating to the capital city increased from 19% to 27%. As we shall see later, migration is expected to play a large part in future population growth for Kigali City.

HOUSEHOLD CHARACTERISTICS HOUSEHOLD SIZE

Ten per cent of all Rwandan households are in Kigali City. While the national average for household size stands at 4.8, households in Kigali City average 4.7 persons. Furthermore, inside Kigali City, only the district of Gasabo matches the national household size, with Kicukiro and Nyarugenge holding the district average (see table 1). Almost one quarter (24%) of these households in Kigali are headed by women, according to estimates (EICV3, 2011).

TYPE OF HABITAT

The 2005 administrative reforms were intended to bring people away from isolated habitats as a means to improve their access to public services, as well as move them into modern residential habitats. Indeed, planned resettlement has, to a large extent, achieved part of the objectives of the reform. According to EICV3 data, 62.6% of Kigali City households live in urban informal (unplanned housing) or "slum" areas. Only 2.4% of households in Kigali City live in modern planned areas. Nationally, less than one percent (0.6%) of households live in such planned habitats. Despite the city status, still 21.9% of households in Kigali live in isolated rural housing habitats.

In terms of the type of dwelling, most of Kigali residents (66%) live in single household dwellings. As mentioned above, most of these are informal or unplanned housing areas. Half of these households own the houses in which they live. Forty percent are tenants (renters). The rate of mortgaging is very low at just blow two percent (1.7%). As low as 1% of households are employer provided; while 5.6% have their dwellings provided for free. And on average one can find two persons per bedroom compared to the national average of 2.3 persons per bedroom. Almost 20% of these households have access to internet compared to only 3.7% nationally (that is, at least one person in a household having phone or modem internet). Significant for space management, you find that less than one half of one percent (0.3%) of households live in a multi-storied building with one or more households ("flats").

OWNERSHIP OF DURABLES

Ownership of durable goods is relatively higher in Kigali City. According to EICV3 (2010-2011) more households in Kigali City own a living room suite compared to 14% nationally; 36% own a television set (6.4% nationally); 11% own a computer to 1.7% nationally; and 80% own a mobile phone against 45% nationally. Kigali City households, however, have less ownership of bicycles and radios: 13% to 4.8% on the former and 60% to 57% on the latter.

Social Infrastructure and Human Resource Development

The social infrastructure for Kigali City is part of a broader national development aspirations articulated in the Vision 2020 long-term strategy. Vision 2020 is further elaborated through a set of medium term development objectives, the Economic Development and Poverty Reduction Strategy (EDPRS).

Vision 2020 articulates human resource development as crucial for transforming the country into a "sophisticated knowledgebased economy." Accordingly, the provision of improved services in education and health sectors is seen as a means "to build a productive and efficient workforce." These ambitions are true for both Rwanda as a whole and Kigali City in particular.

	NUMBER OF HH	POPULATION	HH SIZE
Nyarugenge	60,262	282,730	4.7
GASABO	99,447	476,250	4.8
Kicukiro	64,056	301,486	4.7
KIGALI CITY	223,765	1,060,466	4.7

Baseline Source: DHS 2010

KIGALI CITY CURRENT HOUSEHOLD SIZE BY DISTRICT

EDUCATION IN RWANDA

While vision 2020 acknowledges the importance of educating Rwandans at all levels – primary, secondary, and tertiary – it identifies a particular commitment for hitting the targets set by the United Nations 2000 Millenium Declaration and the Millennium Development Goal for "Universal Education for All" (Vision 2020) including the removal of gender disparities in education (Education Sector Strategic Plan 2010-2015).

The broad objectives of the education sector, therefore, are to improve and increase :

- Access to education for all
- Quality education at all levels
- Equity in education at all levels
- Effective and efficient education system
- Science and technology and ICT in Education
- Promotion of positive values, critical thinking, Rwandan culture, peace, unity and reconciliation

While improvements in access are being registered, major challenges in the provision of quality education remain. This is largely a result of a "low caliber teaching staff" (Vision 2020: 13).

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PRIMARY EDUCATION

The government of Rwanda is on target to achieve universal primary enrollment by 2015, a Millennium Development Goal. Significant progress has been registered in this regard. Between 2001 and 2006, net enrollment rate increased from 74% to 86%. By 2006, completion rates were at 42% while repetition rates stood at 17% (EDPRS 2008:21). Higher rates of coverage are largely due to the fact that public education is free at this level – including the first three years of secondary school.

Rwanda achieved the goal for gender parity by 2005. Indeed, by 2006, more girls than boys attended primary school, 87% and 85% respectively. While success was registered in regard to entry, the completion rates for girls were still lower than that for boys. If the education system is to deliver quality education, the pupil to teacher ratio must be reduced. In 2006 this ratio stood at 70:1, with a goal to reduce it to 50:1 by 2012. Likewise, completion rates were expected to double between 2006 and 2012 from 52% to 100% (EDPRS 2008).

The reduction of the illiteracy rate is one of the major outcomes of education at the primary level. Nationally, the illiteracy rates for women declined from 34% to 30% between 2000 and 2005; the rate for men reduced from 24% to 23% (RDHS 2010).

The provision of free public education at the primary level and at the lower secondary level (tronc commun) is intended to ensure that all Rwandans have access to at least nine years of basic education "critical for enabling the country to achieve its goal of becoming a knowledge-based and technology driven society" (ERDPS

2008: 22).

Kigali City, more than any other region in the country, is closer to meeting the Millennium Development Goal of universal access to primary education. The net attendance rate for Kigali City stands at 94.1% compared with the national level of approximately 92%. A relatively small improvement has been registered in this regard since 2005 when net attendance rate was 92%.

While the official age for completing primary school in Rwanda is 12 years, many do not finish on time. This has implications for secondary school enrollment.

SECONDARY EDUCATION

When it comes to access to secondary school education, there is a significant drop both for Kigali City and Rwanda. Net attendance rate for the former is 41% while attendance for the latter is just 20.9%. The extent of this disparity means that the rate of access to secondary education for Kigali City is almost double for the rest of the country, say, for the Western province where the net attendance rate is 21.3%. This rate means that one in every five children in the secondary school age group (13-18) attends. While the rate remains low, it represents significant increase in access to secondary education, a doubling from the 2005 rate of 10 percent (EDPRS 2008).

To emphasize, completion of primary education does not necessarily translate into entry to secondary education. A small percentage transitions to from the primary to the secondary level.). The expansion of free basic education to the first three years of secondary school is expected to increase

PRIMARY SCHOOL ENROLLMENT IN KIGALI CITY BY DISTRICT

	NUMBER OF SCHOOLS	NUMBER OF STUDENTS	NUMBER OF TEACHERS	STUDENT/ SCHOOL RATIO	STUDENTS/ TEACHER RATIO
DISTRICT	199	89,615	2,074	450	199
Gasabo	143	89,615	2,074	627	143
Кісиківо	116	66,122	1311	570	116
NYARUGENGE	458	245,352	5459	536	458

Source: MINEDUC department of statistics, 2011

SECONDARY SCHOOL ENROLMENT IN KIGALI CITY BY DISTRICT

	NUMBER OF SCHOOLS	NUMBER OF STUDENTS	NUMBER OF TEACHERS	STUDENT/ SCHOOL RATIO	STUDENTS/ TEACHER RATIO
DISTRICT	30	13,289	562	443	24
Gasabo	22	10,455	227	475	46
Kicukiro	15	7,304	341	487	21
Nyarugenge	67	31.048	1,130	463	27

Source: MINEDUC department of statistics, 2011

the rate of coverage. A more "gradual" strategy is envisioned for increasing secondary enrollment. The 2008 EDPRS set an "interim target" at 30% by 2012 and a long-term target at 60% by 2020.

A major challenge in secondary education has been lagging completion rates. Similar to the challenge in primary education, while the official age for completing secondary school in Rwanda is 18, the proportion over that age still attending secondary school is as high as 20%.

Likewise, the challenges of coverage versus quality at the primary level are also found at the secondary level. The strategies for increased access and quality for secondary education are intended to help improve employability for those wishing to enter the labor market without going on to higher education (EDPRS 2008).

TERTIARY EDUCATION

Kigali City disproportionately has the highest representation of students at higher learning institutions (HLIs). Kigali City residents between 16 and 35 years of age attend tertiary institutions at the rate of 8.6%. That is much higher when compared to the national rate of access of just 2.6%. The Western province has only 1.9% of its residents in that age bracket attending tertiary institutions.

While access to tertiary education remains low, these figures represent significant progress over the past decade.

In 2003, only 0.5 per cent of the Rwandan population had a university degree. By 2006, the gross enrollment rate was 3.2 percent. According to the EDPRS (2008:23),

enrollment in the country's 18 institutions of higher learning increased from 10,000 to 27,787 between 2002 and 2005. Government targets for enrollment rates for 2012 were targeted to increase to 4.5%. Challenges for qualified instructors continue to impede the provision of quality education at this level for Rwanda in general and Kigali City in particular. Indeed, nationally by 2006, only 20% of instructors at this level had the "appropriate" qualifications, with a target of 30% by 2012.

TECHNICAL AND VOCATIONAL EDUCATION TRAINING (TVET)

Vision 2020 places particular focus on the development of vocational and technical training, especially in "the fields of technology, engineering and management." Accordingly to Vision 2020, programs under the TVET system should be especially geared towards those who have completed secondary education and other members of society, especially the women and youth. The TVET programs are intended to impart promote entrepreneurship by imparting such skills necessary for small business development, among others (Vision 2020: 13). By 2006, the TVET program was graduating 8,250 graduates with a 2012 target of 135,000; instructors would be increased to 300 and five regional centers established (EDPRS 2008:35). Again here we find challenges of access and quality.

LITERACY

Given that Kigali City has comparatively higher rates of access to education subregionally, it follows, therefore, that it would also have relatively higher levels of literacy. Indeed, the literacy rate for Kigali City is close to 90%, for residents in the age bracket of 15 to 24, the youth. For the general population of 15 years above, literacy levels are still relatively higher for Kigali City at almost 87%. For these two age categories, the national literacy rates stand at approximately 84 and 70 percent, respectively.

Similarly, residents of Kigali City above 15 years of age are computer literate at much higher rates against their peers nationally at around 15% and 3%, respectively. Other Challenges

Major challenges remain in the education sector, where by 2010 23% of women and 17% of women have no formal education whatsoever. Sixty seven percent of women and 70 percent of men have only had education up to primary level; eleven percent for men and 9 percent for women had education up to the secondary level. Those with education attainment beyond the secondary level make up just one percent of the population.

THE HEALTH SECTOR

Access to healthcare in Rwanda in general and Kigali City in particular has been increasing. More people are visiting health centers for consultation; and more health centers are emerging to bring services closer to the people. According to the EICV3, the proportion of Rwandans visiting a health center has increased over the past five years from 49% to 66%. Residents of Kigali City more than any other region tend to consult medical practitioners when faced with ill health, at a rate of 45% compared to 40% nationally. Indeed, it takes less time for Kigali residents to reach a healthcare center. only 34 minutes while their counterparts nationally take an average of 60 minutes to reach one. Clearly, this disparity is a result of favorable proximity to health centers in a relatively large city center of Kigali.

When in ill health, Kigali residents are more likely to visit a healthcare center (45%) followed by a clinic (26%), a dispensary 13% and a hospital (12%). Others are likely to visit a consultant's home (4%), while close to a half of one percent visit pharmacies. Likewise, Kigali City has the highest rates of access to health insurance.

HOSPITALS AND HEALTH CLINICS IN KIGALI CITY BY DISTRICT

	NUMBER OF SCHOOLS	NUMBER OF STUDENTS	NUMBER OF TEACHERS	STUDENT/ SCHOOL RATIO		
GASABO	14	10	2	26		
Kicukiro	8	3	2	13		
NYARUGENGE	8	5	2	15		
TOTAL	30	18	6	54		

Source: MVK, health and environmental unit, 2011

Close to 73% of Kigali residents have access to health insurance; the national rate is close to 70%. The highest percentage is insured through mutual insurance (60.55). One half of one percent (0.4%) is insured through their employer, while 7.6% are insured through Rwandaise Assurance Maladie (RAMA).

INFANT AND MATERNAL MORTALITY RATES

Infant and maternal mortality rates have been dropping for Rwanda and Kigali City. According to the Demographic and Health Survey (2010), the maternal mortality rate has decreased nationally over the past decade from 1,071 deaths per 100,000 births in 2000 to 750 deaths per 100,000 births in 2005, whereas the current ratio of 487 deaths per 100,000 births (RDHS 2010). Infant mortality rates have, similarly, been decreasing. The same demographic survey indicates that between 2000 and 2005, infant mortality rates stood at 75 deaths per 1000 births, whereas the current rate is 50 deaths per 1000 births. Furthermore, the survey shows that the under-five mortality rates have also been decreasing

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from 133 deaths per 1000 live births to 76 over the same period.

For Kigali City, according to the same survey, the under-five mortality rates are relatively lower than the national levels. Regionally, for instance, the under-five mortality rate for Kigali City was 79 per 1000 births while in the Eastern Province that rate was 125 deaths in 2000.

Overall, however, for Kigali City, and nationally, the EDPRS reports that mortality rates declined between 2000 and 2005 by close to 20%, with maternal rates decreasing by almost 30%.

MALARIA AND HIV/AIDS

Malaria and HIV/AIDs continue to present major challenges in the health sector. By 2006, HIV prevalence was estimated at 3% of the adult population. The national rates for HIV prevalence have remained steady at 3% between 2005 and 2010. The rates for men and women are 2% and 4%, respectively (RDHS 2010: 212).

Kigali City has the highest rate of HIV prevalence at 7 percent (RDHS 2010). This is twice as high as other provinces. For Malaria, however, various interventions have helped halve its prevalence since 2007 from 2.6 to 1.4 percent, in children aged six to 59 months and among women between 15 and 49 years of age, halving the prevalence rate from 1.4 to 0.7 percent, nationally.

While challenges in expansion of coverage and quality of healthcare provision remain, significant progress has been registered in the health sector including improved access to health services, reducing the time it takes to reach a health center as well as increase access to health insurance both nationally and for Kigali City.
FUTURE TRENDS

METHODS

The study used DEMOPROJ, which is software developed by USAID project Health Policy Initiative to make population projections. Population projections are made based on 1) current population and 2) fertility, mortality, and migration rates for Rwanda both at the present and projected across time across three scenarios. DEMOPROJ was used by NISR to calculate the population projections 2007-2022 using the 2002 census as the baseline.

The program requires information on the number of people by age and sex in the base year (2010), as well as current year data and future assumptions about the total fertility rate (TFR), the age distribution of fertility, life expectancy at birth by sex, and the appropriate life model table, and the magnitude and pattern of international migration.

BASE YEAR POPULATION

The study used the data from EICV3 as the most recent source of data for population by age group. The best source to use is a national census as it provides population by age and sex, both by the national, district and provincial level. However, as the last census was in 2002, and given the large changes that have occurred in fertility and mortality rates since then, these are likely to lead to inaccurate estimates of current population and therefore future population. For this reason it is preferable to use the EICV3, which estimated population by age and sex based on the representative sample taken. However, this information is not disaggregate by district or province, it

is necessary to make some assumptions in order to calculate the splits for Kigali City/ rest of the country. The main assumption is that this distribution of age and sex is relatively constant across the entire population of Rwanda. If we compare the ratio of men:women across the provinces of Rwanda and Kigali City then we see a range from 46.7:53.3 to 48.7:51.3 which is not a large distribution around the mean of 47.6:52.6, so the distribution of sex is likely lead to reasonable estimates. Evidence from the Demographic and Health Survey of the distribution of sex across different age groups for rural/urban splits provides evidence that there is not a great deal of variation between these two populations and supports the use of this methodology given the lack of disaggregation within the EICV3 report.

TOTAL FERTILITY RATE

The Total Fertility Rate (TFR) is the number of live births a woman would have if she survived to age 50 and had children according to the prevailing pattern of childbearing at each age group. Estimates are taken from the DHS 2010 results, which showed incredible declines in national and regional fertility as a result of population control campaigns and increased access to family planning. All three assumptions (high, medium, low) use the 2010 results as their baseline. Future fertility rates are projected based on national targets (Vision 2020) and fertility trends from population transition theory: as access to health care and management of child illness improves, infant and under-five mortality rates decline.

Population transition theory predicts that this will lead to a decline in fertility rates, as parents feel more certain that their children will survive through to adulthood. Population is therefore predicted to initially increase because of the delay in the switch from high to low fertility behaviour. Rwanda is currently experiencing this population increase because fertility is still relatively high. Extensive government sensitisation has however decrease fertility from 6.1 to 4.6 children per woman, from 2005 to 2010, nationally. Desired fertility now stands at a mean of 3.3 children for all women.

HIGH FERTILITY CASE

The high fertility case assumes different rates of decline for Kigali City and the rest of the country. As TFR is already down to 3.5 for Kigali City, a high fertility case would reflect a moderate decrease across down to a TFR of 3 by 2040. The rest of the country is likely to experience a sharper decline in fertility from 4.7, bringing it down and more in line with the TFR for Kigali. The high fertility case predicts a decline to TFR 4.1 by 2020 and to TFR 3.2 by 2040. The high fertility case means that country-wide Rwanda does not achieve its Vision 2020 target of TFR 3, achieving it only for Kigali by 2040.

MEDIUM FERTILITY CASE

The medium fertility case similarly predicts different TFRs between Kigali and otherwise. It predicts a fall to TFR 3 for Kigali by 2020, achieving the Vision 2020 target. Fertility then remains constant as Rwanda becomes a middle income country, until 2035 when fertility decreases further down to an average of 2.5 children for Kigali by 2040. For the rest of the country, fertility is similarly predicted to fall but at a sharper rate given the initial inequality in fertility rates. The medium case predicts a fall down to TFR 3.5 by 2020 and a continual steady decline down to 2.8 by 2040.

LOW FERTILITY CASE

The low fertility case is based primarily on the astonishing fertility declines that have been witnessed between the DHS Survey in 2005 and 2010. To this extend the low fertility case may well be attainable, but predicting the success of population control programs all the way to 2040 is difficult. Similarly, the sharp declines seen in recent years may have just been because Rwanda was starting at a very high initial point and there may be diminishing marginal returns to current public health initiatives. The low case does predicts that fertility disparities will disappear and both Kigali and the other provinces will achieve the Vision 2020 goal of 3 children per family. Population will then continue to fall as the economy grows, down to TFR 2 which is consistent with the fertility rate in developed countries.

AGE SPECIFIC FERTILITY RATES

Age Specific Fertility Rates (ASFR) is the number of birth in a year for a population of a given age and sex to the midyear population of that same sex and age group. These were calculated across the time period using the United Nations model table for sub-Saharan Africa.

LIFE EXPECTANCY

Currently, life expectancy at birth is 59.5 for women and 56.5 for men. The Preston curve predicts that life expectancy increases as per capita income increases and this is the assumption which is used to predict the increase in life expectancy as the economy grows. Life expectancy per age range is predicted using the Coale-Demeny Life Tables, selecting the North family as the table which best matches the from Rwanda, and was used in the 2007 population projections.

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FUTURE POPULATION GROWTH

The study projected the population for Kigali City from through 2040. According to the high hypothesis, the population of Kigali City is expected to grow from 1,060,045 to 5,077,205.

Growth rates are expected to increase from the current rate of 6.82% until 2015 (6.86%) and thereafter begin to reduce at a lower rate between 2021 and 2024. Significant decrease is expected between 2030 and 2040 when the population growth rate is expected to be 2.98%. Much of this growth is potentially driven by two principal factors. The high assumptions for fertility rates are expected to remain between the current rate of 3.5 and 3.0 in 2040. The second factor is that of immigration into the City, with its own pull factors, as we shall see.

TRENDS IN URBANIZATION

One of the consequences of the 2005 administrative reforms that restructured the boundaries of the city of Kigali is in terms of determining the residential areas considered urban. The recent household survey (2010), for instance, treats the sectors of Jali, Ndera, and Rusororo, all in Gasabo district, as both rural and urban. The populations in these sectors are, accordingly, ascertained to belong to rural or urban Kigali city. On the other hand, the same survey treats Kicukiro district as fully urban, without a single sector determined as rural or both. Following the lead of the treatment of Gasabo, this study considers the sectors of Gahanga and Masaka (save for the modern community resettlements, imidugudu) not to be fully urban, as there remain residential areas that seem characteristically rural.

Accordingly, these adjustments provide for an urban/rural split of approximately 76 to

PROJECTED POPULATION FOR KIGALI CITY



24 %..The population trend for Kigali city reflects shifts towards off-farm economic production. Indeed, by 2040 when the urban population for Kigali is expected at around 95%, projected off-farm employment is expected around 97.5%; that is, less than 5% the population in Kigali City is expected to continue earning their living from agricultural production.

MIGRATION TRENDS

As earlier discussed, the lure of the city and the opportunities perceived in the city centers plays a large part in this trend in migration. Many of these, according to the household survey, have come to the capital city in search of employment opportunities. As key infrastructure is put in place, more movement from other regions of the country is expected, as well as migration from regional countries, and beyond (see fig. 6, below). Some of the key infrastructural developments that expected to drastically increase traffic to Kigali City, as well as serve a catalyst for in-migration include:

- -Construction of the Isaka (Tanzania) to Kigali (and possibly DRC and Bujumbura) railway line
- -Completion of the Masoro duty free Zone -Completion of the Bugesera international airport

Completion of these projects is expected between 2015 and 2025, reflecting the large movements of people thusly:

-High case, doubling to 2020 and then increasing to 250% of the original level by 2025 before levelling off back to half of the number by 2040

-Medium case, doubling by 2025 and then decreasing back to original level of 2010 -Low case, constant to 2025 and then decreasing to half the current level.

URBAN POPULATION FOR KIGALI CITY 2010-2040



NET MIGRATION TO KIGALI CITY



TRENDS IN HOUSEHOLD SIZE

This study feels that present household size may be smaller due in part to the effect of genocide. For instance, one of the consequences of the genocide is that many families only have one parent. In the future we expect households to reflect the average number of children plus two parents. Future trends for household size, therefore, do not greatly reduce, as a result of, for instance, projected levels of economic growth and success in interventions of population control such as improved family planning.

The table shows trends based on the relationship between current household size and fertility rates, with minimal change in household size.

The study indicated earlier that the government of Rwanda understands that education is a key component of human resource development. In addition to challenges of access and quality earlier raised, the age structure of Kigali City places education as the crux in development planning, especially in the context of the country's quest for a knowledge-based economy.

To calculate the demand for schooling we look at current and future projected education attendance rates, and multiple them by the population for each of the relevant age groups to estimate the number of students at primary, second and tertiary educational levels across time.

The trends suggest increased entry into schooling at the secondary and tertiary levels at significantly higher rates than presently. By 2040, the demand for education at the secondary school level will reach present levels of demand at the primary school level. Concerns for quality education and reducing the student/ teacher ratio to desired levels – such as EDPRS targets –seem to merit serious consideration and appropriate planning, especially given these trends for demand and access.

IMPLICATIONS AND CONCLUSION

Projected levels of economic development suggest that Kigali City will continue to grow. The City is likely to attract both internal and international migration, especially following the completion of major infrastructural developments, which are expected to attract people to the City. Projected levels of economic development suggest that Kigali City will almost fully become urbanized by 2040, with less than 5% of its population in agricultural production, as the vast majority of the city's population (around 97.5%) will gain employment in off-farm activities.

The demand for access to secondary and tertiary education will increase significantly increase from the current levels.

While the current age structure shows that the majority of the population is relatively young, under 40 years of age, high projection assumptions show that by 2040 Kigali City is expected to have close to 500,000 children under the age of five. This has implications for infant and maternal mortality rates in the health sector. Furthermore, Kigali City is expected to have close to 900,000 in the school attending ages of 5 to 14, who will need to be planned for, especially, in the human resource development sector. The next critical age group is that between 15 and 64 whose key concern is likely to be access to employment. Clearly, the concerns in the three key age brackets are crosscutting, as a healthy workforce that is educated is key for economic transformation.

KIGALI CITY PROJECTIONS: HOUSEHOLD SIZE (2010-2040

House Hold Size For kigali	2010	2015	2020	2025	2030	2035	2040
LOW	4.7	4.35	3.85	3.85	3.55	3.35	3.35
MEDIUM	4.7	4.35	4.05	4.05	4.05	3.85	3.55
HIGH	4.7	4.35	4.25	4.15	4.05	3.95	3.85

EICV3 for baseline, fertility levels for projections

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APPENDIX 2 : CASE STUDIES FOR TRANSIT ORIENTED CITY



Urban Growth Axis in Curitiba (Left), 2004 Density of Curitiba (Mid), 2000 Zoning in Curitiba (Right) Source: IPPUC (2009)



PUBLIC TRANSPORTATION IN CURITIBA

CITY SPECIFICS

City size	430 km2
Population	1.75 Mil
GDP	US\$ 8000
Passenger using BRT	85%

KEY STRATEGIES

The key transport strategy adopted in case of public transportation in Curitiba are as below:

- Trunk-feeder mode of Operation
- Major economic activities along key • corridors



The Trinary Road System in Curitiba Source: IPPUC (2009)

Evolution of the Integrated Bus Network in Curitiba, 1974–95 and 2009 Source: IPPUC (2009)

- Acquired land and reserved row along key corridors
- Developed social housing amenities & • schools etc. along BRT axes.
- High density development allowed in areas reached by public transit.

Relevance to Kigali

The Study's relevance to Kigali is highlighted as below:

- Comparable Size of the City and aspired Economy
- Higher and desired share of Public Transport
- Bus oriented Transit System
- High density along the Transit Corridors •

DRAFT EXISTING CONDITIONS ANALYSIS & VISION REPORT- APRIL2012

PUBLIC TRANSPORTATION IN SINGAPORE

CITY SPECIFICS

City size	712 km2		
Population	5.18 Mil		
GDP	US\$ 50714		
Passenger using Public Transit	70%		

KEY STRATEGIES

The key transport strategy adopted in case of public transportation in Singapore are as below:

- Developing Public Transit as a choice mode
- Integrated bus and Rail system
- Effective management of Roads
- Integrated Transport and Land use planning: Development around transit station integrated with centre, served by high quality public transport (LRT, Metro, Bus), 400m walking radius from LRT/MRT stations
- Targeting 70% share by Public Transit
- Extensive Green Network

Relevance to Kigali

The Study's relevance to Kigali is highlighted as below:

- Comparable Size of the City
- Higher and desired share of Public Transport
- Integrated Bus and Rail Transit System
- Transit Oriented City with compact development
- Extensive Green Network for Pedestrians



Singapore Road Network Source: LTA



Singapore Rail Network Source: LTA



Singapore Transit Oriented Development at Seng Kang New Town

DISTRICT PHYSICAL PLANS FOR KICUKIRO AND GASABO, KIGALI, RWANDA

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