Chapter 4
Towards a Smart Metropolitan Regional Development—Spatial and Economic Design Strategies: Conakry

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Abstract The dynamic transformation of the Conakry Metropolitan Region from a population of 38,800 inhabitants in 1950 to a population 1.9 million inhabitants million in 2015 has occurred in different paces, times and places in terms of numbers, urban form and structure (density distribution, and compactness). When a city reaches one million or more of population size, it becomes more complex for its planning, design and management compared to a small city. For instance, when a city reaches one million inhabitants, its accessibility will be largely determined by elements of its urban form and structure as well as elements of transport infrastructures and, recently, elements of Information and Communication Technologies (ICT). This accessibility determines in large the interaction between economic and spatial design strategies. After the introduction, this study is divided in five sections. **The first section** presents the "Conceptual framework of the Smart Metropolitan Regional Development" of the study; **The second section** presents "Urbanization of the Conakry Peninsula in Time and Space"; **The third section** focuses on the "Urban Accessibility and Mobility"; **The fourth section** presents "Urbanization, Economic Growth and Metropolitan Regional Development" including economic growth, human development and sustainability, inclusion, resilience and prosperity; **The fifth section presents** "Towards a Smart Metropolitan Regional Development" including human development, environmental sustainability and city prosperity; **The sixth section**, based on the development of the previous sections, presents the "Spatial and Economic Design Strategies for a Smart Conakry Metropolitan Regional Development".

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4.1 Introduction

Large urban agglomerations such as Conakry provide opportunities for economies
of scale and agglomeration, but it will also call for large investments in infras-
tructures to respond to the increased demand for water, sanitation, solid manage-
ment, energy, streets and public spaces, and mobility, etc. They will also require
efficient institutions for the management of social demand and equity such as on
education and health as well as protection of people against violence and insecurity.
Economies of scale and agglomeration economies are, for instance, greater in
metropolitan areas where accessibility infrastructures are able to answer accessi-
bility to services' needs with higher access to markets and resources than those
where accessibility is impeded by deficient accessibility infrastructures. Efficient
accessibility infrastructures will allow large-scale production of goods and services
that can be distributed within the metropolitan regions and beyond with time, cost
and reliability opportunities [1]. Without efficient accessibility systems, a
metropolitan region losses its economic power and remains just clusters of dis-
connected settlements. The latter is the current situation of the Peninsula of
Conakry as most African metropolitan region.

As a peninsula in the Atlantic Ocean, Conakry is located in a very low zone with
an average elevation of 13 metres above sea level and with several watersheds
mostly backfilled. Considering its geographical location, Conakry has the potential
to be an agriculture, green city in addition to its huge potential of fish production.
Wetlands areas are sources of income from agriculture, livestock, and crafts, among
other activities. They play an important role in maintaining the water quality and the
prevention of natural hazards. These are also ideal places for reception and
reproduction of waterfowl which are indispensable elements for the ecological
balance of aquatic environments and key links in the food chain, hence the
importance the preservation of wetlands. If well planned and designed, Conakry can
be a smart city where citizens enjoy high quality of life.

Conakry as most African cities has not been able so far to respond to growth in
accessibility demand and several other needs such as access to water, sanitation,
management of solid waste, and streets and other public spaces key elements of a
city foundation. From a population of about 38,800 inhabitants in 1950, the
Conakry urban agglomeration (the Conakry Peninsula and other connected urban
centres) has a population of 1.9 million inhabitants million in 2015. For the
Peninsula alone, its population is estimated at 1.7 million according the 2014
Guinea Population and Housing Census (Map 4.1).
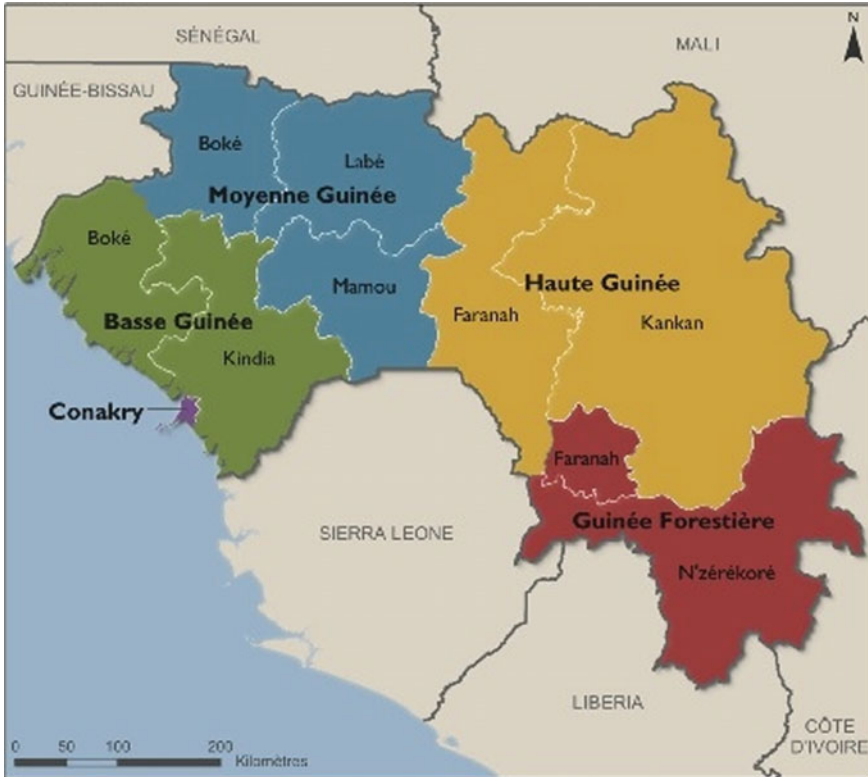
Map. 4.1 Map of the Republic of Guinea. *Source* National Institute of Statistics, Republique de Guinee, 2012, Demographic and Health Survey, and Multiple Indicators Cluster Survey

The existence of planning tools and instruments, particularly in the 1980s, has not prevented the proliferation of unplanned settlements along the urbanization of Conakry Peninsula. Due to lack of affordable housing and land, most people, particularly the urban poor, are forced to settle on the periphery of the Peninsula, particularly in the municipalities of Mototo and Ratoma. Since independence in 1958, Conakry extends considerably all along the peninsula limited only by its physical borders (the mangrove) and administrative boundaries (the prefectures bordering Dubréka and Coyah) [2]. The Conakry Peninsula has not been well planned with sufficient land allocated to streets and public spaces, and it lacks smart basic infrastructure and smart institutions and laws [3]. Many settlements in the Peninsula lack a sewerage system and rainwater drainage facilities, and adequate waste management sites are missing, which are key components of smart basic infrastructure along with connection to water and energy. Flooding during rainy seasons as well as uncollected garbage is frequent phenomena in all parts of the Peninsula, but particularly in poor settlements. Frequent energy shortages also affect the city's economy. In addition, infrastructure for non-motorized transport (e.g. pavements or sidewalks for walking and bicycle lanes for cycling) is often

lacking, poorly developed, or on the decline. This has led to high incidences of traffic fatalities involving pedestrians and cyclists. Streets that provide space only to motorists are characterized by congestion and high CO_2 emissions [4]. These challenges are associated with poor land administration and governance, characterized by corruption and lack of transparency in public as well as private transactions.

The 2014 Guinea population (Table 4.1) and housing census provides the distribution of the population across region.

Table 4.1 Distribution of the Population of Guinea, 2014

REGIONS/PREFECURES		Ménages	Maseulin	Féminin	Total
BOKE	BOFFA	27 799	104 347	108 236	212 583
	BOKE	61 107	222 124	228 154	450 278
	FRIA	15 784	46 077	50 623	96 700
	GAOUAL	28 199	91 204	102 408	193 612
	KOUNDARA	17 635	63 167	66 807	129 974
	Sous-total région de Boké	**150 524**	**526 919**	**556 228**	**1 083 147**
CONAKRY	DIXINN	20 063	68 574	67 214	135 788
	KALOUM	9 345	30 810	31 697	62 507
	MATAM	20 133	71 536	71 719	143 255
	MATOTA	91 444	334 515	332 125	666 640
	RATOMA	95 786	328 320	324 463	652 783
	Sous-total Ville de Conakry	**236 771**	**833 755**	**827 218**	**1 660 973**
FARANAH	DABOLA	**25 297**	85 392	95 745	181 137
	DINGUIRAYE	26 827	94 387	102 082	196 469
	FARANAH	34 403	134 663	145 507	280 170
	KISSIDOUGOU	39 375	136 381	147 397	283 778
	Sous-total région de Faranah	**125 902**	**450 823**	**490 731**	**941 554**
KANKAN	KANKAN	46 867	233 617	239 742	473 359
	KEROUANE	**27 838**	102 126	105 421	207 547
	KOUROUSSA	29 148	130 55	138 072	268 630
	MANDIANA	22 760	167 873	168 126	335 999
	SIGUIRI	64 044	346 276	340 726	687 002
	Sous-total région de Kankan	190 657	980 450	992 087	1 972 537
KINDIA	COYAH	35 892	127 108	136 753	263 861
	DUBREKA	45 650	162 656	167 892	**330 548**
	FORECARIAH	32 716	116 500	126 442	242 942
	KINDIA	62 872	212 994	226 620	439 614

(continued)

Table 4.1 (continued)

	TELIMELE	49 153	129 954	154 455	284 405
	Sous-total région de Kindia	**226 283**	**749 212**	**812 162**	**1 561 374**
LABE	KOUBIA	16 633	45 533	54 637	100 170
	LABE	56 600	**143 583**	175 355	318 938
	LELOUMA	29 714	68 998	94 071	163 938
	MALI	42 168	134 957	153 044	288 001
	TOUGUE	21 472	55 788	68 492	124 280
	Sous-total région de Labé	**166 587**	**448 859**	**545 599**	**994 458**
MAMOU	DALABA	27 158	59 852	**73 825**	133 677
	MAMOU	58 139	148 157	170 824	318 981
	PITA	54 182	123 999	154 531	278 530
	Sous-total region de Mamou	**139 479**	**332 008**	**399 180**	**731 188**
NZEREKORE	**BEYLA**	38 089	**159 859**	166 223	326 082
	GUECKEDOU	45 455	138 407	**152 204**	290 611
	LOLA	28 232	81 654	89 907	278 561
	MACENTA	44 230	**133 045**	145 411	278 456
	N/ 1 RFKORI	60 970	**194 055**	202 894	396 949
	YOMOU	18 089	**55 262**	59 110	114 371
	Sous-total région de NZérékoré	**235 065**	762 281	**815 749**	1 578 030
Total Guinée		**1 471 268**	**5 084 307**	**5 438 954**	**10 523 261**

Source Republique de Guinee, 2015 (Decret D/2015/229/PRG/SGG), Portant Publication des Resultats Definitifs du Troisieme Recensement General de la Population et de l'Habitation realise du 1er mars au 2 avril 2014

Considering that the population of Grand Conakry Metropolitan Region will double the population of the Peninsula by 2040, the Government of Republic of Guinea commissioned a study for the "Grand Conakry Vision 2040". The study proposes various scenarios of territorial settlements. These scenarios are aimed at preventing disasters that can hamper ecological, social, economic and urban development. From these scenarios, a "synthesis, balanced and controlled scenario" is structured around three levels of intervention: (1) at the metropolitan level to develop and strengthen urban polarities; (2) at the agglomeration level to channel and structure the Conakry urban extensions; and (3) at the peninsula level to infill the city along a urban renewal approach. Recognizing that the Master Plan of the city is out-dated, the "Grand Conakry Vision 2040" will first focus in the development of a new generation of master plans: the master plan of the Grand Conakry and the national land use planning scheme (SNAT). The Grand Conakry Vision 2040 will consist of:

- At the metropolitan level, to develop and strengthen urban polarities: (1) Fixing and attracting populations in urban polarities; (2) Building a strong metropolitan region based on territorial solidarity and; (3) Preserving the natural and agricultural environment to enhance the productive force of the territory.
- At the agglomeration level, to channel and structure urban extensions: (1) Preventing the process of urban sprawl in order to preserve the natural environment through the establishment of perimeters for urban land use; (2) Structuring, reorganizing and controlling the urban extensions.
- At the peninsula level, to infill the city along the urban renewal approach: (1) Building an efficient, safe, healthy and pleasant capital and; Optimizing the use of the soil by densification of its structure to accommodate new urban areas with improved living conditions.

The Conakry case study will consist of analysing the economic and spatial strategies undertaken by the Government of the Republic of Guinea in the Grand Conakry Vision 2040 for a Smart Conakry Metropolitan Regional Development. It will be developed through the following sections:

The first section "Conceptual framework of the Smart Metropolitan Regional Development" is based on its City Foundation (urban planning, basic infrastructures and land tenure) and Institutions as well as on the Economic Development, the Infrastructure Development, Environmental Sustainability, the Social Development, the Social Inclusion, Disaster Risk Exposure and Resilience, and Peace and Security. One element of the City Foundation, which is the spatial design, and the element of Economic Development will play the role of interface vis-à-vis the other elements of the conceptual framework. Economic and Spatial Design Strategies along cannot make a regional metropolitan region smart, the ways they interplay with the other dimensions are crucial.

The second section is specifically dedicated to Urbanization of the Conakry Metropolitan Region in Time and Space covering: The Formation of the Conakry Metropolitan Region from 1950–2015; Guinea's Urban System; spatial planning and change in urban land use of the Conakry Metropolitan region, elements of the city foundation.

The third section focuses on the Urban Accessibility and Mobility: Streets as drivers of urban accessibility; and Transport modes and infrastructures, traditional focus of urban mobility studies.

The fourth section will present "Urbanization, Economic Growth and Metropolitan Regional Development" including economic growth, human development and sustainability, inclusion, resilience and prosperity. Though cities are potentially engine of prosperity with their power of economies of scale and agglomeration as well as of technology innovation and diffusion of ideas, the Relationship between urbanization and development had been uneven in the Conakry Metropolitan Region. This section will assess the main reasons, including the urban form and structure, and the urban accessible that have contributed to the relatively low economic performance of the Conakry metropolitan compared to many cities with similar size cities in other developed regions.

The fifth section presents "Towards a Smart Metropolitan Regional Development" including human development, environmental sustainability and city prosperity.

The sixth section, based on the development of the previous, presents the "Spatial and Economic Design Strategies for a Smart Conakry Metropolitan Regional Development". The main objective of the Grand Conakry Vision 2040 is to "improve the living conditions of the residents of Conakry and adapt land-use planning and planning policies to the rapid urbanization of the metropolitan region" [5]. The "Grand Conakry—Vision 2040" is conceived as the preliminary framework for the elaboration of a future Master Territorial and Urban Planning. Its objective is to define the main key points and themes to be considered in order to make Conakry a modern liveable metropolis safeguarding the environment. The study aims to be the reference framework for several ministerial departments, communities and local authorities to set a long-term urban development target by 2040 [6].

4.2 Conceptual Framework, Methodology and Data

The Grand Conakry Vision 2040 occurs in the era of the digital revolution in Conakry as it occurs everywhere in the world. For these past 15 years, the Guinean government has taken various initiatives favourable to the development and use of ICT at all levels. It has created legal institutional framework to support regulatory mechanisms on the development and use of ICT. We are taking it further with the development of a holistic approach in the making of Conakry a Smart Metropolitan region through a better integration of ICTs in the planning, designing and managing of metropolitan regions. The opportunities for ICT to support the overall urban challenges and opportunities are enormous, and the Conakry Metropolitan Region must integrate and use ICT solutions to facilitate the greater provisioning of urban services. Through increased efficiency and innovation, ICT increases economies of scale and agglomeration, and promote diffusion of knowledge, even at the smaller human settlements. Small settlements as small firms are benefiting from ICT in making available their goods and services beyond their territories. Virtual offices, virtual networks, teleconferences are increasing large public participation and inclusion. Digital firms can start and scale up quickly with relatively little staffing or capital investment. ICTs harness the benefits of agglomeration economies in easing circulation of goods and services and encouraging polycentric urban development and allowing synergies between centres and sub-centres. They intensify urban nodes and corridors to maximize the benefits of concentration.

Following the exigency of the city of the 21st century that calls for sustainability, inclusion, resilience and prosperity, the planning and management of human settlements must take into consideration the gain in knowledge on various conditions that make cities smart, green, ecological, liveable and healthy; and the progressive emergence of the ICT infrastructures and their correlates such as social media and in general big data. This is the context where we are introducing the smart metropolitan regional development to unlock the potential of Conakry metropolitan region to be sustainable, inclusive, resilient and prosperous.

4.2.1 Smart Metropolitan Regional Development: Concepts and Components

The New Urban Agenda adopted in October 2016 in Quito encourages governments, including the government of Guinea as a member of the United Nations, to commit themselves to adopting a <u>smart-city approach</u> that makes use of opportunities from digitalization, clean energy and technologies, as well as innovative transport technologies, thus providing options for inhabitants to make more environmentally friendly choices and boost sustainable economic growth, and enabling cities to improve their service delivery (NUA, paragraph 66) [7].

In our study, a smart metropolitan regional development is viewed as a sustainable, inclusive and prosperous metropolitan regional development that promotes a people-centric approach based on three core components—Smart Metropolitan Region Foundation, Information and Communications Technology (ICT) and Smart Institutions and Laws. Here The Metropolitan Region Foundation goes beyond the city foundation and includes elements of mobility across urban centres that form the metropolitan region. First each urban centre must have a smart city foundation and smartly connected to the other urban centres. Smart Metropolitan regional foundation, institutions and laws, and ICT are the pillars of the seven other dimensions of a smart metropolitan region: Infrastructure Development, Environmental Sustainability, Social Development, Social Inclusion, Disasters Exposure, Resilience, and Peace and Security. **Infrastructure Development** complements the basic infrastructure services under each smart metropolitan foundation and extends to actual investment and advancement of services such as transport, ICT, industrial energy, education, health, etc. **Environment Sustainability** is comprised of elements of Climate Change, Biodiversity, Waste Management, energy, transport, building and pollution. **Social Inclusion** includes aspects of participation in decision-makings as well as equal opportunities for growth and prosperity. **Social Development** encompasses elements of education, health, public space, social inclusion and social capital. **Disaster Exposure** incorporates elements of mitigation and adaptation to various disasters such as flooding, droughts, storms and earthquakes. **City Resilience** is composed of elements of city foundation, environment, social capital, and social development. **Peace & security** includes the elimination of all forms of discrimination and violence and conflicts, including domestic violence, violence in public places, crime, armed conflicts, terrorism, etc. An insecure metropolitan region limits opportunities for investment and economic growth and cannot be a smart metropolitan region (Fig. 4.1).

Numerous societal problems are explored and addressed in urban and regional planning agencies, including urban growth, unemployment and economic revitalization, transportation, environmental degradation and protection, neighbourhood decay and redevelopment, conservation of land and natural resources, provision of open space, parks and recreational facilities, etc. New urban planning instruments are becoming available with the worldwide spread of ICTs. They make it possible

Fig. 4.1 Smart Conakry metropolitan regional development conceptual framework. *Source* Adapted from Mboup G et al. (2016). Smart city foundation—drivers of smart cities. In Vinod et al. (2016). Smart economy in smart cities, Springer
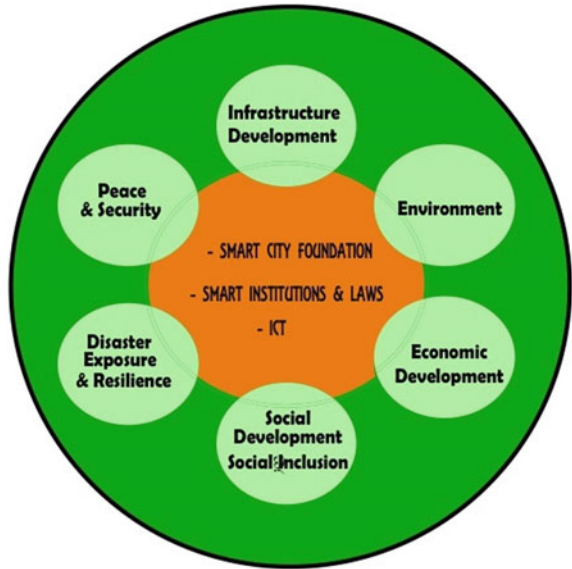
to adopt innovative e-planning approaches, strengthen communication between urban stakeholders, and make communication available at various stages of the planning process. Local governments can engage their citizens with real-time information to gain support for policy initiatives, identify unforeseen concerns, and recognize potential conflicts [8].

Cities are dynamic living organisms that are constantly evolving. ICT has begun to turn some places into real-time cities. This rapidly changing society makes the assessment and anticipation of future needs of city dwellers in terms of services, including transport, water, energy, employment, education and health, even more problematic. To address the complex problems of city planning it is not sufficient just to be concerned with the physical structure of the city; the interplay of intangible economic, social and environmental factors needs to be considered as well [9]. Planning procedures make use of models that show historic and present situations and communicate planned situations [10]. The introduction of ICTs allows planners and planning departments to carry out new actions or to implement conventional practices through new tools, such as GIS, virtual reality technologies, e-participation devices, including public participation GIS applications, among other tools, with the aim of improving conventional decision-making processes. The provision of better planning and urban management services, more efficient, with lower costs and, at the same time, a more collaborative and participative, transparent and accountable planning decision-making process are some of the basic objectives usually associated with the move from conventional urban planning to e-planning [11, 12].

ICT also can increase economic productivity and competitiveness through increased smart mobility that reduces traffic congestion and commuting costs. Efficient and fast transport, in turn, can increase labour productivity by reducing

commuting times, and increasing worker productivity. ICT reduces the use of motorized means and transport and promotes walking and cycling. This will improve the overall health of city residents, thereby reducing the health and economic costs of workers who are absent due to illness. Another important benefit is on consumer expenditure, as less is spent on cars and fuel. Non-motorized means of mobility support specific industries, such bicycle shops, tourism, retail activity, construction and real estate development that highlight liveability. It can also lead to a drop in the share of the household budget devoted to motorized means of transport, such as cars, which are expensive.

The digital dividends are real and the Conakry metropolitan region must take the opportunity to efficiently integrate the use of ICT in all sectors of its development. From the beginning of the 21st century a digital citizenship, particularly the "Millennial" generation, has started to emerge in Conakry as in many African cities. The rapid adoption of digital technologies in the economy will have huge benefits directly as well as indirectly. However, ICT alone will produce little in the smart metropolitan regional development. 'Smart' is not an end in itself; It is the way ICT is integrated in the city development that will determine the city smartness. Maximizing the digital dividends requires better integration of ICTs with the other factors of smart cities such as: city foundation, infrastructure development, environment sustainability, social development, disaster prevention, resilience, peace and security. ICT can be seen as substitution and catalyst factors, but the other factors (or the analogue part) of the operation are crucial in making smart economy. Those factors include the city foundation, institutions and laws, infrastructure development, social development, social inclusion, environmental sustainability, disasters prevention and resilience (particularly in the context of climate change), peace and security. Most tasks have an aspect that cannot be automated by technologies and that requires human judgment, intuition, and discretion. This is where lies the crucial role of human capital associated with institutions and laws, efficient governance, management and administration. Without improvement on accountability at all levels, ICT alone cannot change the outcome of the economic productivity equation. African Countries that are able to swiftly adjust to this evolving digital economy will reap the greatest digital dividends, while the rest are likely to fall behind. This is the context where we are introducing economic and spatial design strategies for a smart metropolitan regional development to unlock the potential of Conakry metropolitan region to be smart, sustainable, inclusive, resilient and prosperous.

4.2.2   Urban Policies, Planning and Legislation

The Republic of Guinea has a number of spatial planning and management instruments at the territorial, regional and urban levels, produced from the second half of the 1980s along with the liberalization and decentralization of the national economy during the Second Republic. These instruments include, among others, the National Territorial Planning System in 1991 (Schéma National

d'Aménagement du Territoire—SNAT), the Regional Planning and Development Schemes of Maritime Guinea, the Conakry Urban Development Plan, the Land and Estate Code, and the Urban Planning Code. To complement this system, other documents such as Urban Audits and Referential Urban Plans (Plans d'urbanisme de reference—PUR) were developed from 2000. Similarly, the Ministry of Urban Planning, Housing and Construction has also been in the process of adopting the Construction and Housing Code. The Guinean government also adopted the Conakry Urban Development Plan [Plan de Développement Urbain de Conakry (PDUC)]. It has also adopted four Regional Spatial Planning and Development Schemes (Schémas Régionaux d'Aménagement et de Développement—SRAD). At the local level, in order to guide major development actions, urban planning and development schemes (les Schémas d'Aménagement et d'Urbanisme—SDAU) were also conceived for 14 secondary cities out of 33 and four rural development communities [13].

From a situation analysis, the Conakry Urban Development Plan encompasses various land use planning for sustainable urban development including: (a) long-term urbanization scenarios; (b) urban form and structure; (c) residential, administrative, commercial and industrial zoning; (d) land tenure administration; (e) sectorial studies including on housing, equipment, transport, infrastructure and urban services; and (f) decennial programming. The National Territorial Planning System (SNAT) defines the structuring elements, which, among others, the territorial organization, the program or development areas and an urban framework of five levels of development centres, communication axes, large natural balancing areas, regional-level secondary structure and implementing institutions [14].

Along the development of urban and territorial planning guidelines and instruments, the Guinean government have adopted several codes land and planning codes, including: Urban Panning Code (Code de l'urbanisme), Land and Estate code (Code Foncier et Domanial), and Building and Construction Code (et du Code de la Construction et de l'Habitation) [15].

The land and Estate code was elaborated and adopted in 1992. It deals with the general rules applicable to the land development, the determination of land use plans concerning local authorities, parts of local authorities or groups of local authorities are determined by law or regulation. The code also prohibits the occupation of Maritime Public Land. Adopted by the law L98/N° 012/1998 the Urban Planning Code includes a regulatory part and a legislative part. The code deals with the foundations of town planning in the Republic of Guinea; it provides town planning rules that incorporate the national urban planning by-law, master plan of urban planning, detailed planning codes; building permit, alteration and demolition, etc. [15]. The Building and Construction code provide rules and regulations on, for instance: the distance to be respected in relation to the occupation of the DPM is fixed at 100 m. Due to global warming and rising sea levels, this distance may be reviewed on the basis of a preliminary study of this phenomenon (Article 26, Title II: Chapter 1); urban renewal operations, urban restructuring in accordance with the requirements of the local SDAU or POS (Article 58 Title III: Chapter 1).

Guinea has also made a special commitment at the international level to promote sustainable and resilient urbanization as promulgated in the Sustainable Development Goals (SDGs) adopted in September 2015, the New Urban Agenda adopted in October 2016, the COP 21 (Paris Declaration), the Sendai Framework on Disaster Risk Reduction, the Addis Ababa Declaration on Population and Development and the Africa Agenda 2063.

However, due to the low level of implementation of urban legislation, rules and regulations, as it is observed in most African cities, urban planning and management guidelines as well as the urban planning, land and building codes were not respected along the urbanization of Conakry. Most settlements in Conakry have occurred unplanned. Many households have been forced to settle in flood prone areas due to inaccessibility to planned land in the city of Conakry. Due to poor land administration and governance, there is no compliance with standards of occupancy of the space leading a high building density and irregularity of the urban fabric. Building in unplanned wetlands without adequate drainage systems expose the population of Conakry to flooding that cause various human, material and financial damages and losses. Industrial areas have also been transformed into human settlements exposing the population to air pollution. More than two-thirds of households in Conakry and other urban centres reside in informal settlements that lack most basic services such as connection to water and drainage facilities [13].

4.2.3 Methodology and Data

The Smart Metropolitan Regional Development is composed of several dimensions. Put them together to assess the degree of smartness will require the development of composite indices using sophisticated multi-level statistical analysis including Principal Component Analysis. The complexity of composite index is the fact that it is strongly influenced by several factors including: the normalization, the standardization and the degree of association between variables and the number of variables that compose the index. The analysis of the Conakry Smart Metropolitan Regional Development (SMRD) will consist first of the analysis of each of its components with the production of individual indicators such as the proportion of household with access to improved water, followed by a development a composite index, the SMRD index (SMRDI) with sub indices such as the Smart City Foundation Index (SCFI) built upon the spatial planning, the land tenure and the basic infrastructure indicators. However, an index can also be conceptualised differently using different variables. This calls for caution when interpreting a composite index. For instance the Quality of Life is conceptualised and measured in different ways across studies. The Human Development Index includes indicators of health and education, alongside an economic component (Gross Domestic Product or GDP); the Legatum Prosperity Index considers quality of life to be multidimensional, including both wealth and wellbeing; The Economist Intelligence Unit's Quality of Life Index links life satisfaction to health, family life and community life;

and the OECD's Well-being Initiative has two dimensions: 'material living conditions' and 'quality of Life' [16]. The following section will provide the different components of the SMRDI and the variables used for their development.

Putting the dimensions together to develop the Smart Metropolitan Regional Development Index (SMRDI)

The SMRDI, which is built here, is meant to serve research as well as policies. For the latter, the SMRDI will be built using existing mechanisms of the production of indicators globally as well as nationally. Building the SMRDI through existing mechanism of development of indicators such as the monitoring of the Africa Agenda 2063, the Sustainable Development Goals (SDGs), the New Urban Agenda, the Sendai Framework, the COP21, the Addis Ababa Declaration on Population and Development as well as the monitoring of national programmes and plans will ease its implementation at the local level for SMRD policies. As part of the international communities, Guinea has also endorsed all the above global agendas. Box 4.1 provides for each dimension of the SMDR variables, quantitative or qualitative, included for its measurement.

Box 4.1 Smart Metropolitan Regional Development Index (SMRDI)

Dimensions	Definitions/variables
City Foundation	**Spatial Planning** Planned settlements, Streets, Other Open Public Spaces **Land Tenure** Land: Documentation or perceived eviction Housing: Proportion of urban population living in slums, informal settlements or inadequate housing **Basic Infrastructures** Connection to piped water, Connection to sewerage system, Connection to electricity, management of solid waste
Institutions & Laws	Urban Planning Codes, Urban Policies, Urban Plans, Unplanned settlements, Resilient building codes, standards, development permits, land use by-laws and ordinances, and planning regulations
ICT	Connection to internet, Mobile phone, Computer, Broadband
Infrastructure development	Transport and road infrastructure, Energy, Knowledge infrastructure, Health infrastructure
Environmental sustainability	Air quality (PM10), CO_2 emissions, energy and indoor pollution
Economic Development	City product, Employment Primary, Secondary and Tertiary sectors

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Dimensions	Definitions/variables
Social Development	Education: literacy, primary, secondary and tertiary enrolment Health: life expectancy, under-five mortality rates, HIV/AIDS, morbidity and nutrition: Social capital, Public space
Social inclusion	Income/consumption Inequalities: Gini coefficient, Health, Education, Access to basic services
Disaster Risk Reduction/Resilience Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population Adoption and Implementation of national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
Peace & Security	Proportion of population that feel safe walking alone around the area they live; Proportion of women and girls aged 15 years and older subjected to sexual violence by persons other than an intimate partner in the previous 12 months, by age and place of occurrence; Proportion of ever-partnered women and girls aged 15 years and older subjected to physical, sexual or psychological violence by a current or former intimate partner in the previous 12 months, by form of violence and by age; Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities; Proportion of population that feel safe walking alone around the area they live

Source Mboup, G. et al., 2018 (Forthcoming). The Relevance of Smart City in the African Context. Springer. All the variables of this table are not included in the Conakry SMRDI due to lack of data

Data sources and quality assurance

Data are generally obtained from various sources depending on the level of analysis. For the SMRDI, as an impact product, population-based data is most indicated since they provide information on people's quality of life. Since independence, Guinea has already conducted three population censuses (the last one was held in 2014) and several household surveys such as Demographic and Health Surveys, the

Multiple Indicators Cluster Surveys, the Living Standard Measurement Survey and several other household surveys. In addition to these population-based data, the analysis of spatial form such as density, compactness, streets call for the use of the Geographical Information System (GIS) for the analysis of remote sensing data with the integration of population-based data. However, these population-based as well as GIS sources feature limitations in providing information on urban planning, housing, land tenure, etc. For these variables, our study will heavily rely on official administrative reports including the Visions Habitat 2010, the Grand Conakry Vision 2040, the Urban Audits, the National Territorial Planning document (Schema National d'Amenagement du Territoire-SNAT), etc. The analysis of the component of the SMRDI such as Institutions and Laws call for a Policy Analysis of urban legislations, rules and regulations in Guinea, it is more a content analysis of administrative records rather than a spatial or a population-based analysis. Finally, the development of the SMRDI will be based on quantitative as well as qualitative data: population-based, spatial and content analysis, etc.

Challenges and emerging successes in the definition of urban components for the development of the SMRDI

The development of the SMRDI will face challenges such as data comparability, the delimitation of urban boundaries, etc. Critical issues and huge challenges the development of the SMRDI will face is the choice of data sources in the situation where it is noted significant discrepancies between national sources. Lack of data comparability and non-compliance with international standard make the development of SMRDI challenging. A lack of uniform definitions across data sources poses an even greater challenge for aggregating data and comparing levels of SMRDI [17]. Urban human settlements have various definitions: urban agglomeration, metropolitan region, city proper, municipalities, etc. These definitions also vary across countries [18]. The **urban agglomeration** is defined as the built-up or densely populated area containing the city proper; suburbs, and continuously settled commuter areas. This may be smaller or larger than the metropolitan area. Other similar UN definition: Comprises a city or town proper and the suburban fringe or thickly settled territory lying outside, but adjacent to, its boundaries. A single large urban agglomeration may comprise several cities or towns and their suburban fringes. (United Nations. 1998. Principles and Recommendations for Population and Housing Censuses). This has been regularly published by UNDESA and it forms the official reference of urban population as in the Urbanization Prospects publication. The **metropolitan area** is the set of formal local government areas, which are normally taken to comprise the urban area as a whole and its primary commuter areas. The **city proper** is the single political jurisdiction, which contains the historical city centre [19]. The Grand Conakry Vision 2040 considers the three components at three levels: the city of Conakry as the Peninsula, the urban agglomeration through the extension of the peninsula and the metropolitan region through the development or reinforcement of urban polarities.

Other important measurement, one can be interested is how the spatial growth occurs along the population growth; a crucial information for spatial planning. There is **emerging success in disaggregation of urban growth** made by UN-Habitat and partners using remote sensing and GIS to analyse changes in urban

extent in different components such as infill, extension, inclusion and leapfrog. City growth within the same urban extent is considered as **city infill** that "consists of all built-up pixels added in the new period that occupy urbanized open space within the urban extent of the earlier period". City can also grow beyond its previous urban extent in a contiguous manner. This type of city growth is known as city **extension** that consists of all built-up pixels added in the new period that constitute **contiguous** urban clusters that are **attached** to the urban extent of the earlier period. The growth of city can also occur through **inclusion** that consists of all urban, rural, or suburban built-up pixels that were **outside** the urban extent in the earlier period and are now within the urban extent of the new period. There is also another trajectory of growth where city expand to **over rural open space** that were **not attached** to the urban extent of the earlier period or to new extension clusters. This is known as leapfrog [20]. All these categories of spatial growth have occurred along the urbanization of the Conakry Metropolitan Regional over a century and will be analysed here.

4.3 Conakry Peninsula in Time and Space

4.3.1 Urbanization of Conakry Peninsula

Cities form and grow in many different parts of the world for various different reasons such as rural-to-urban migration, natural population growth, economic opportunities, politics, environmental changes, social conflicts, etc. In a given country, the way these factors play are determinant for the size and the national distribution of cities that, in turn, form the urban system. Conakry became the capital of French Guinea in 1904 and prospered as an export port, particularly after a railway to Kankan ease accessibility to the interior of the country for the large-scale export of groundnut, for instance [21]. In decades after independence, the population of Conakry boomed, from 50,000 inhabitants in 1958 to 600,000 in 1980, year of economic liberalization and rural migration, to over 1.9 million in 2016. Since 1950, the city of Conakry was, indeed, marked by continuous increase of its share in the national urban population from 15 to 30% in 1960. This exponential growth made it to reach 58% in early year, 1970, and 62% in 1980. However From 1980, there is a decline of its share to less than 40% with the growth of other cities such as the second largest city in Guinea, NZerekore (343,000 inhabitants) [22].

Since the independence of the Republic of Guinea in 1958 to the advent of the Second Republic in 1984, urbanization of the Peninsula was mainly the product of the development of informal settlements. Public or "parapublic" production of housing was limited to the preparation of land and the construction of housing at a very high cost, without concern for profitability and even less respect for comfort standards. During that period, the Republic of Guinea received very limited financial assistance from the international communities [13]. For over a quarter

century the Government of Guinea hardly benefited from certain forms of advantageous loans granted by international financial institutions. Private land development and housing production have been largely the responsibility of the informal sector. Faced with the weakness of the public offer and the private real estate development, the populations occupied space in an anarchic way. This resulted to the proliferation of informal settlements lacking most basic services such as connection to water, electricity and sewerage systems.

Today the Conakry Peninsula is composed of five municipalities: Kaloum, Dixin, Matam, Matoto and Ratoma. Along the urbanization process, the urban form and structure of Conakry is characterized by: (1) a linear geographical structure along the peninsula (five kilometres wide over forty kilometres); and (2) a historical centralized organization of the development of the city, with all port activities, decision-making functions and administrations, concentred in the municipality of Kaloum, in an area of just 3 km^2, less than 1.5% of the urbanized area [5]. The Population in Conakry Peninsula is estimated at 1.7 million (1,660,973) inhabitants according to the 2014 Population and Housing Census. While most of the administrative and commercial buildings are located in the municipality of Kaloum that hosts 4% of the Conakry population, the majority of the Conakry population are concentrated in two municipalities, Matoto and Ratoma, 40 and 39% respectively. The municipalities of Dixin and Matam have a share on the Conakry population of 8 and 9% respectively [23].

The five municipalities of Conakry were created like the other municipalities of the country by the ordinance N° 019/SGG/PRG/90 of April 21st, 1990 on the organization and the functioning of municipalities in the Republic of Guinea. The **municipality of Kaloum**, subdivided into 13 neighbourhoods ("quartiers") is a peninsula of 25 km^2 of surface that consists of an insular part and a continental part. It is surrounded on all sides by the Atlantic Ocean except the eastern side, which borders with the municipalities of Matam and Dixinn. **The municipality of Dixinn,** subdivided into 24 neighbourhoods, is a residential area where are located the University of Conakry and several embassies. It is bounded on the West by the municipality of Kaloum, on the East by the municipality of Ratoma, on the North by the Atlantic Ocean and on the South by the rails of Niger and the municipality of Matam. **The municipality of Matam**, subdivided into 24 neighbourhoods, is limited to the North by the rails of Niger, to the South by the Atlantic Ocean, to the West by the municipality of Kaloum, to the East by the arm of the sea separating the Bonfi market district from that of Dabondi. **The municipality of Ratoma**, subdivided into 34 neighbourhoods, is a semi-rural area located in the Northeastern periphery of the capital. It is bounded on the East by Dubréka prefecture, on the west by Dixinn commune, on the South by Matoto municipality and on the North by the Atlantic Ocean. **The municipality of Matoto**, subdivided into 38 neighbourhoods, is located in the coastal area southeast of the capital; it covers a territory, largely covered with mangroves; it extends from the bottom of Dabondy to Lansanayah. It is limited to the East by the Prefecture of Coyah, to the West by the Commune of Matam, to the North by the municipality of Ratoma through the railway Conakry-Niger and to the South by the Atlantic Ocean (Figs. 4.2 and 4.3).

Fig. 4.2 Spatial illustrations of the municipalities of Conakry. *Source* Republic of Guinea, 2017. Administrative sub-divisions of the city of Conakry
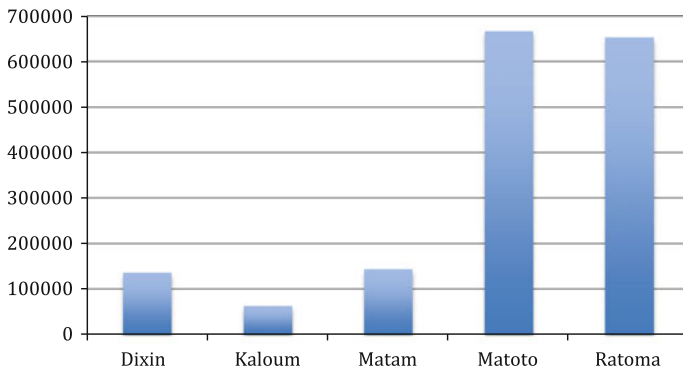

Fig. 4.3 Population of Conakry Peninsula, 2014. *Source* Institut National de la Statistique, Republique de Guinee, 2015. Census 2014

Data from the UNDESA's urbanization prospects 2014 revealed that during the period 1950–2015, the urban agglomeration of Conakry had increased from a population of 38,800 inhabitants in 1950 to 1.9 million inhabitants. The Conakry urban agglomeration population figure is slightly higher than the Conakry Peninsula figure as published in the 2014 Population and Housing Census due to the fact that it includes other urban settlements connected to the Peninsula (forming the whole urban agglomeration) (Fig. 4.4).

As shown in Fig. 4.5 (Growth rates of the urban population of Conakry, 1950–2015), the highest annual population growth rate occurred between 1950 and 1970 with a level of 12% or above. Since 1970, the population of Conakry urban agglomeration continues to increase but by a continuous smaller pace until it reach a growth of 3% in 1980. Since 1980, the annual growth rate of the urban agglomeration seems to stabilize around 3%.
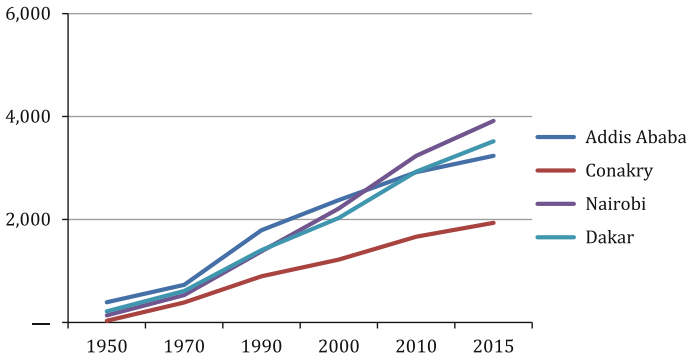
Fig. 4.4 Urban Population Growth of Conakry and other African cities of similar sizes in 1950. *Source* Data from United Nations (2015) World Urbanization Prospects: The 2014 Revision, UNDESA, Population Division, New York, NY, http://esa.un.org/unpd/wup/index.htm
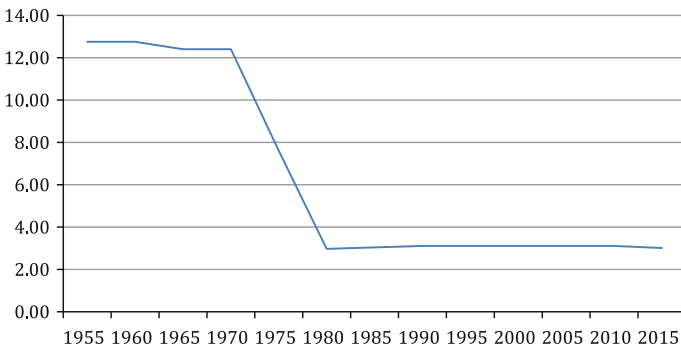

Fig. 4.5 Growth rates of the urban population of Conakry (1950–2015). *Source* Data from United Nations (2015) World Urbanization Prospects: The 2014 Revision, UNDESA, Population Division, New York, NY, http://esa.un.org/unpd/wup/index.htm

4.3.2 Guinea Urban System

The spatial distribution of cities of different sizes throughout the national space constitutes a country's urban system. The urban system is determined by the way cities are geographically distributed in the country according to their size. In the urbanization process, some countries were able to develop a balanced system of cities with no city does predominantly hold a large share of the urban population while others concentrate their population in one city that become a primate city. The conditions under which urban primacy emerges can vary greatly and evolve with country size, population density, and the stage in its urbanization process, among

other factors [24]. Changes in primacy can be affected by all of the factors affecting urbanization more generally, including natural growth, migration and reclassification of settlements from rural to urban. A country's urban system can be linked to the organization of the government at the national, regional, and local levels [25]. The share of city to the total urban population can be a good indicator of a city performance, attractiveness or a simple political preference [26]. In turn, the urban system may determine the need for specific urban development policies, consistent with the size, growth and function of each city. For instance, when all the national investments, all health, education and commercial infrastructures are vested in a particular city, such as Conakry, people do not have other choices except moving to that city.

The Urban primacy as defined here characterizes the urbanization process in the Republic of Guinea during the last 60 years where Conakry has been a primate city with more than half of the national urban population living in the urban agglomeration. Since 1950, the city of Conakry was marked by continuous increase of its share in the national urban population from 15 to 30% in 1960. This exponential growth made it to reach 58% in early year, 1970, and 62% in 1980. However From 1980, there is a decline of its share with the growth of other cities such as the second largest city in Guinea, NZerekore (343,000 inhabitants). The regional capital of the regions of Kindia, Labé, Kankan and N'Zérékoré are only home to about one-sixth of the country's urban population; the third of the national urban population is distributed among the 29 other urban centres, including three regional capitals of the regions of Boké, Mamou and Faranah [13]. The permanent primacy status of Conakry is similar to the situation of Dakar in Senegal but opposite from most cities in East Africa where though they were primate cities at the onset had lost their primacy along the urbanization process. For instance in Kenya, the share of Nairobi in the national population was 49% in 1960, but in 2015 Nairobi represented only 33% of the national population. In Ethiopia there was a drastic reduction of the demographic power of Addis Ababa from 47 to 17%. In North Africa, expect in Egypt there is no single country that hold a share in the national urban population that reached 30%.

The permanent primacy status of Conakry can be associated with the fact that most administrative and commercial institutions are located in the city. According to the classification of the SNAT, in the hierarchy of city, only Conakry can be considered of higher order of development centre [13]. There is stagnation in many intermediate cities and the absence of a network of small urban centres offering basic services. There is need to empower other cities in other region in order to decentralize urban development in the country and create a balanced urban system. Conakry, alone, will not be able to distribute wealth to other regions (Fig. 4.6).
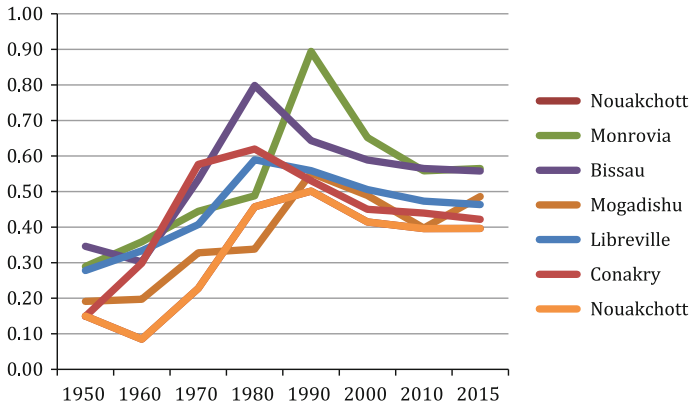
Fig. 4.6 Share of Conakry and other African cities in the national urban population (1950–2015). *Source* Computed using data from United Nations (2012) World Urbanization Prospects: The 2014 Revision, UNDESA, Population Division, New York, NY, http://esa.un.org/unpd/wup/index.htm

4.3.3 The Demographic Dividends of the Conakry Peninsula from 1950 to 2015

The monocentric form of the city of Conakry with most of the services located in the municipality of Kaloum has reached its limits leading to huge traffic congestion. The mobility in Conakry is heavily affected by the fact the city was conceived as a monocentric city where residential areas and workplaces are distinct, with the later concentrated in the centre of the city. Residential areas were also designed along economic class lines. This has led to social and economic fragmentation that disadvantage lower income in accessing basic services and prevent social interaction and integration. In addition to monocentric form of the city, most households are built in unplanned settlements that lack most basic services, particularly in Matoto and Ratoma, leading to frequent flooding and several other social and economic negative externalities.

Urban Densities as factor of economies of scale and agglomeration

The population size is an important component of urbanization, but to address various questions in urban economics, environment and infrastructure development, information on density of the population is valuable [27]. Positive production or residential externalities, as well as negative externalities such as congestion, are function of density among others [28]. Various policy responses as well as programmes and projects such as on transport and infrastructure are subject to how population is distributed across a city. Important factors of land use such as land prices should be also considered in this exercise as part of elements that can feed the land legislation and investment in infrastructure [29]. From an economic point of view, the higher the density of an urban agglomeration is, the lower are the costs of transactions, and the more prosperous is the economy. A deficient spatial structure

fragments labour and consumer markets into smaller less efficient markets; it contributes also to higher transactions costs by unnecessarily increasing distances between people and places. It increases the length of the city infrastructure network and therefore increases its capital and operating costs. Lower densities and segregated land uses increase economic costs in terms of average commuting distances, public utility provision, and energy consumption. From an environmental point of view, a deficient spatial structure can decrease the quality of life by increasing the time spent on transport, by increasing air pollution, and contributing to the unnecessary expansion of urbanized areas in natural sites. Poor environmental quality can also lower a city's productivity.

Results from the 2014 Guinean Housing and Population Census show that Conakry is densely populated, across all its five municipalities (Dixin, Kaloum, Matam, Matoto and Ratoma) with an average of 3706 inhabitants per square kilometre on the total land area of the Conakry Peninsula of 450 km^2 (as 2009) [30].

With the right empowerment, Conakry's young population can lead the vision for the city of tomorrow and work for it. The ability of the youth, as the "Millennial", to adopt emerging technologies and transfer experiences from other parts of the world must be key drivers of Conakry's smartness in the long term. Various studies show that Africa's young people will be the driving force behind economic prosperity in future decades, but only if policies and programmes are in place to enhance their opportunities [31]. These policies and programmes include factors such as a strong rule of law, efficient bureaucracies, government stability, lack of corruption, and a stable business environment that encourages domestic and foreign investors. In order to benefit from its youthful population, the Conakry Metropolitan Region must embrace smart education driven by the availability of ICT and respond to the requirement of the job market of the 21st century. It is also important to encourage young people's participation in public life, and in policies, programmes, and services. However, youthful population could also present a significant risk and threat to social cohesion and political stability if Conakry fails to create sufficient economic and employment opportunities to support decent living conditions for them [32].

4.3.4 The Conakry City Foundation

4.3.4.1 Proliferation of Unplanned Settlements and Lack of Security of Tenure

The results of the survey carried out as part of the development of the "Vision Habitat 2021" strategic document reveal a "generalized precariousness" in terms of housing. Along unplanned rapid urbanization, human settlements occur in disaster-prone areas with lack of most basic services such as connection to water and sewerage systems. Sustainable urban development has been seriously hampered by proliferation of slums and informal settlements in the Conakry Peninsula. Over two thirds of human settlements in Conakry are in such conditions. This situation is

Fig. 4.7 Distribution of irregular settlements (lacking most basic infrastructures). *Source* Republique de Guinee, Ministere de l'Urbanisme de l'Habitat et de la construction, 2011. Politique nationale de l'habitat « Vision Habitat 2021 »

also observed in other Guinean cities. For instance out of 16 settlements in the city of Kindia, 11 are irregular and lack most basic services. In Labé, only a small portion (14%) of the total population lives in relatively well-equipped neighbourhoods. The city of Kankan, this figure is only 4% indicating the informality is general (96%). Similar situations are observed in the cities of Siguiri, Faranah and Kissidougou [13]. The lack of subdivision complicates the implementation of road networks, sanitation, water supply, electricity and other equipment reserves. This limits investment opportunities and plunges these areas into exclusion and marginality.

As illustrated in Fig. 4.7, irregular settlements (red colour) are predominant along the Peninsula, particularly in the municipalities of Matoto and Ratoma where reside 80% of the city's population. Only the municipalities of Kaloum, Matam and Dixin seem not to be affected by the proliferation of irregular settlements, but they represent only 20% of the Conakry population, 4, 9 and 8% respectively.

Information from the Vision Habitat 2021 document features a very dark picture of proliferation of slums and informal settlements in Conakry Peninsula. Towards the Northwest, along National 3, beyond Dubréka, the spontaneous extensions develop significantly in a very constrained environment, trapped between the reliefs and the mangrove. Heading South and South-east from Coyah and North-East along the railway line and from Nationale 1 to Kindia, the urban areas stretch along two axes: towards the commune of Wonkifong, on the one hand, where the constructions infiltrate on the dry mangrove and between the arms of rivers, and to the communes of Toguiron and Kendoumaya, on the other hand, where the urbanization unfolds in "fishbone" along the Nationale 4. Towards the Northeast, the urban extension develops mainly along the railway line, between PK45 and National 1 to Kouriah. On the other hand, the urban development is relatively limited along the National 1 on the portion located between Coyah and Kouriah because of a more accidental relief. This picture illustrates the fact that the proliferation of irregular settlements covers all corners of the Conakry moving towards the municipalities of Matoto and Ratoma as illustrated by the red colour of the map [13].

The Guinean government has put in place holistic urban development pro-grammes for the "eradication of spontaneous habitat, rehabilitation of degraded housing in the central districts of Conakry" such as those in Vision Habitat 2021 and, recently, the Grand Conakry Vision 2040. These programmes aim at achiev-ing, in two decades, "cities without slums" including rehabilitation, restructuring, and land regularization of irregular neighbourhoods as well as poverty reduction. It was expected that a pilot programme be launched in Conakry and in the fast-growing major cities (annual rate of urban growth above 5%, thus doubling the population every fifteen years) and very rapidly growing cities (annual rate of urban growth above 7%, thus doubling the population every ten years). The national program of cities without slums—diagnosis, inventory and adoption of an urban redevelopment law—was expected to be developed in 2012. The objective is to completely reduce the irregular habitat in Conakry, by 2021 and reduce by 50% the irregular neighbourhoods in large cities, while meeting the needs of other neigh-bourhoods [13].

4.3.4.2 Basic Infrastructures

In a smart city foundation, basic infrastructure such as piped water services, sew-erage facilities, electricity sources and solid waste management are considered along the city planning. They are part of the city planning prior to settlements of households. In a sustainable city foundation, use of improved water from piped water services, sewerage facilities, solid waste management, energy for lightning is quasi universal. However, for the city of Conakry only connections to piped water facilities are quasi universal with a level of 90%, followed by connections to electricity (64%). The coverage of sewerage facilities is still very low, below 30% in 2012. In Conakry, the public collection of household waste concerns 55% of households. Industrial and toxic waste (contaminated waste from hospitals, labo-ratories, slaughterhouses and mining enclaves) is generally released in the nature, rivers or the sea, and it is treated in the same way as other wastes.

Due to lack of rainwater drainage system, the inadequacies and dysfunctions of the rainwater management network, and the obstruction of natural outlets by human settlements, flooding is frequent in Conakry. The annual rainfall in Conakry is 4000 mm, particularly in the months of July and August. Precipitation is reflected by very intense rainfall typical of the subtropical climate. Associated with this heavy rainfall, the particular topographical situation of the city of Conakry favours recurring floods during the raining season [5].

4.3.4.3 The City Foundation: Spatial Planning, Land Tenure and Basic Infrastructures

A smart city foundation is composed of three elements: Urban Planning & Design, Land Policies and Basic Infrastructure. For a city foundation to be smart, it must be
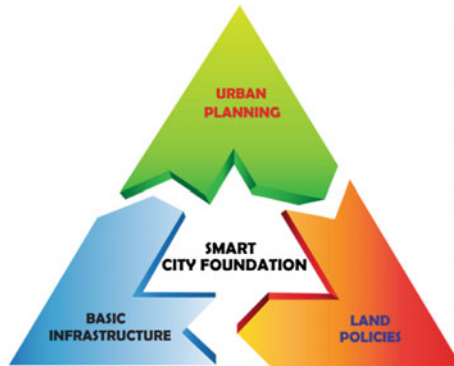
Fig. 4.8 City foundation conceptual framework. *Source* Mboup G et al. (2016). Smart city foundation—drivers of smart cities. In Vinod et al. (2016). Smart economy in smart cities, Springer

inclusive at the onset of the urban planning and promotes mixed neighbourhoods where social clustering is discouraged. Having all the poor living together creates slums and fuels instability and insecurity. Inclusive urban planning eases access to basic services (water, sanitation, housing, education & health) and to decent employment for all. A key element of smart urban planning is a smart street network that reduces travel time and encourages walking and social interactions. Smart urban planning enhances infrastructure development, environmental sustainability, economic and social development; makes cities resilient and prepared to overcome natural disasters; and promotes mixed neighbourhoods where services are walking distances from people's residences (Fig. 4.8).

Using the three main components of the city foundation, we have computed a composite index that represents the overall city foundation, the City Foundation Index (CFI) with values varying from 0 to 1. A value closes to 0 means that a city lacks most of the elements of the city foundation elements, and a value closes to 1 means that a city enjoys most of the elements of the city foundation. The Conakry Peninsula spatial configuration features the tale of a city with the municipality of Kaloum enjoying all key elements that make a city foundation smart: adequate urban planning, access to basic services (electricity, water, sewerage facilities) and a land tenure moderately well administered and governed. The municipality of Kaloum is followed by the municipalities of Dixin and Matam. The municipalities of Mototo and Ratoma lack most of the elements that make a city foundation smart.

While CFI of the municipality of Kaloun is estimated at 0.815, and the CFIs of Dixin and Matam at 0.644 and 0.643 respectively, the CFIs of Mototo and Ratoma are estimated at 0.312, 0.310 respectively. The low level of the CFI of Mototo and Ratoma is due to low coverage of a sewerage system, less than 30% compared to 64% in the municipality of Kaloum. The two municipalities also perform poorly in land governance and administration with a proliferation of informal settlements. While in Kaloum, the majority of households enjoy security of tenure, in the two municipalities less than 20% of households have security of tenure (Fig. 4.9).
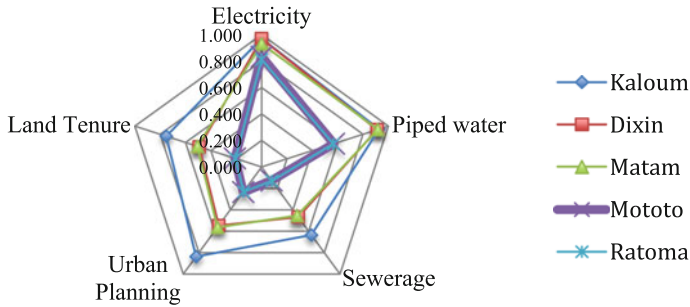
Fig. 4.9 Components of city foundation index. *Source* Computed by the authors

National and local authorities must improve the foundation of the city of Conakry, particularly of Mototo and Ratoma with smart planning, smart basic infrastructures and smart institutions and laws. Smart basic infrastructures, which are particularly of great urgency in these municipalities, include connection to sewerage facilities as well as development of efficient waste management systems. Effecting these changes will enhance the economic value of land, encourage investments, reduce risks from natural hazards, increase resilience and minimize the costs of infrastructure maintenance among various other positive impacts. This calls for use of ICT and GIS in spatial planning, land tenure governance and administration, and management and monitoring of the provision of basic infrastructures.

4.4 Urban Accessibility and Mobility

Development of large urban agglomerations like Conakry constitutes economic and social opportunities as well as challenges. It provides opportunities for economies of scale and agglomeration as well as for diffusion of ideas and innovations, but it will also call for large investments in infrastructures to respond to the increased demand for water, sanitation, solid management, energy and mobility, etc. It will particularly come with increased demand on mobility that must be satisfied with an efficient public transit accompanied with increased spaces for pedestrians and cyclists in order to safeguard the environment while creating economic growth. Economies of scale and agglomeration economies are greater in metropolitan areas where transportation infrastructures are able to answer mobility needs with higher access to markets and resources than those where people mobility is impeded by deficient transportation infrastructures. Efficient mobility will allow large-scale production of goods and services that can be distributed within the metropolitan regions and beyond with time, cost and reliability opportunities [1]. Without efficient mobility, a metropolitan region losses its economic power and remains just clusters of disconnected settlements. The latter is the situation in Conakry as in most African cities, marked by frequent traffic congestions, a major indication of the disjuncture between land-use planning and transport systems in the city. It not only exposes the limitation of a transport-oriented bias to mobility, but also reveals the inefficiency of land-use systems in Conakry. Urban accessibility is shaped by both spatial planning

elements such as: density, compactness, type of city (monocentric or polycentric) and streets, and transport planning elements such as the streets infrastructures and the transport infrastructures. The first three elements of spatial planning—density, compactness, and type of city (monocentric or polycentric)—are presented in previous sections. This section will address one important element of spatial planning—streets—and elements of transport planning and system.

4.4.1 Streets as Drivers of Urban Accessibility

One key element of urban planning is the street, which defines the form and structure of city. In recent years streets have been recognized as an integral factor in the achievement of sustainable urban mobility. A connected street network reduces travel time and encourages walking and social interactions. One fundamental feature of sustainable streets is their connectivity in terms of planning as well as design. With regard to planning, sufficient land should be allocated to streets (at least 25% city's area) and the street network should be sufficiently long to cover all areas. There must be sufficient intersections available (at 100 intersection per square km) to facilitate shorter distances and reduce travel times, and encourage walking and social interactions [33]. A connected street network expands multimodal mobility systems with sidewalks and bicycle paths, ensures eco-efficiency of infrastructural systems, and supports density through integrated infrastructure development, thereby enhancing efficiency and access. In addition to accommodating all kinds of users (pedestrians, cyclists, motorists), sufficient land allocated to streets promotes connections to services that contribute to good health and productivity, such as clean water, sewerage facilities, drainage systems, power supply, and information and communication technologies. It enhances infrastructure development, environmental sustainability, and economic and social development. Streets that provide space only to motorists are characterized by congestion and high CO_2 emissions [34].

The Conakry metropolitan region is not benefiting from all the multiple advantages associated with well-connected streets. With only 10% of its land allocated to streets in its CBD, and less than 5% of land in its suburbs, Conakry suffers from traffic congestion along with the exclusion of pedestrians and other non-motorized means, and further marginalization of the most vulnerable segments of society who rely the most on foot and public transports if they are affordable. In most densely population in Conakry suburbs, there is no space left for mobility except very tiny streets where people have to squeeze through. The streets are also narrow, not paved, and lack sidewalks; this result in competition for space with motorists, often exposing pedestrians to accidents. While Conakry as in many African cities has high pedestrian flows, less than 20% have pedestrian footpaths [35]. In many of these settlements, public transport services are accessible in few arterial streets where people have to walk several kilometres to reach them. During the raining season, the already limited walking spaces are flooded, forcing people to

Table 4.2 Shares of various modes of transport in use in selected cities

Country	City	Walk
AFRICA		
Burkina Faso	Ouagadougou	–
Cameroon	Douala	60
Cote d'ivoire	Abidjan	22
Ethiopia	Addis Ababa	30
Ghana	Accra	12
Guinea	Conakry	78
Kenya	Nairobi	47
Mali	Bamako	–
Nigeria	Lagos	
Rwanda	Kigali	5
Senegal	Dakar	–
Uganda	Kampala	–
United republic of tanzania	Dar es Salaam	26

Source UN-Habitat, 2013. Streets as Public Spaces and Drivers of Urban Prosperity. [Author; Mboup, G.]. Nairobi, Kenya

stay at home, losing many productive hours. This in turn has serious social and economic impacts on the city's economy (Table 4.2).

Besides the low level of land allocated to streets, the street networks in Conakry as in most African cities are generally substandard. Streets lack service lanes, pavements and are poorly maintained, with limited street lighting the street planning and design do not anticipate the polycentric form of cites and the rapid increase in the use of private cars. In most African cities, few streets are paved and most lack sidewalks as shown in Fig. 4.10 [36], with Conakry having a percentage of paved road of 32%.

During the preparation of the Urban Development Plan of Conakry, the secondary and tertiary road network was evaluated at 590 km of roads distributed as
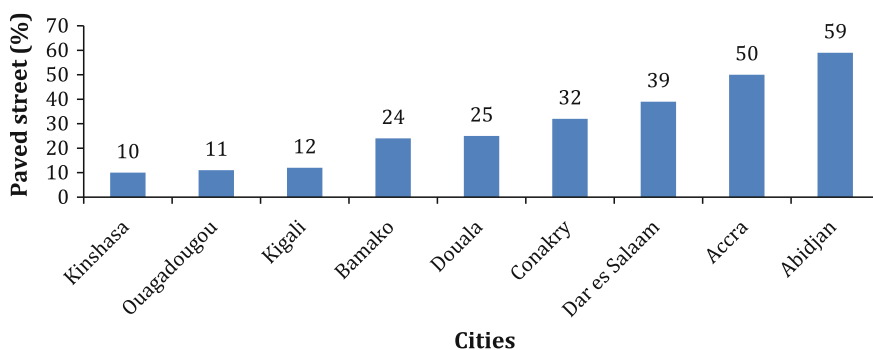

Fig. 4.10 Percentage of paved roads for selected African cities. *Source* Ajay Kumar and Fanny Barrett (2008) Stuck in traffic: urban transport in Africa, Africa infrastructure country diagnostic (AICD), obtained from city

follow: 120 km of paved tracks and 470 km of unpaved tracks. Only 119 km were covered, a proportion of 20% located mainly in the oldest sectors of the city of which the third was in an acceptable state. The rest of the network consisted of dirt tracks. During the past 15–20 years, the secondary network has, however, recorded some changes [14]:

- The total length of this network has increased from 590 to 970 km, an increase of 380 km (64%). This reflects a rapid expansion of urbanization by spreading despite the phenomenon of densification of some neighbourhoods. In the absence of support for urban extensions by the State or municipalities, the new roads created add to the inventory of unpaved roads and accentuate the degradation of the network;
- The coated line has been enriched by 60 km. It went from 120 to 180 km; an increase of 50% but its share in the total network remained the same 22% against 20% initially. The quality of the paved road has improved;
- The tracks in acceptable condition (good or average condition) represent more than 95% of the track lanes compared to only 33% initially, which indicates the effort undertaken for the development and the maintenance of the road network.

Composite Street Connectivity Index

Street connectivity is determined by the amount of land allocated to streets, the length of the street network and the number of intersections along the network. The proportion of land allocated to streets and the length of the street network is not sufficient to assess street connectivity. A city with wide streets within a very limited street network and low intersection density is considered a city with low street connectivity because the width of the streets is not complemented by a larger street network and higher street density. Similarly, a city with a lengthy street network and dense intersections may not qualify as a city with high connectivity if the streets are very narrow. The Composite Street Connectivity Index (CSCI) aims to assess the connectivity of a street considering its width, its length and the number of intersections, all in relation to the total land area of a city. Interestingly, some cities in this group have low levels of land allocated to streets, but higher intersection density (ID) increases the value of their CSCI. Conakry city core has a LAS index moderately low (10%). However, the Conakry suburbs suffer from low LAS, limited street density with few intersections. In these suburbs, which are mainly unplanned, provisions of basic services as well as means of transport remain challenges. Conakry belongs to the group of Cities with a CSCI below 0.500. Cities in this group have poor street connectivity due to low levels of land allocated to streets, low street density and low intersection density. Their CSCI is less than half the highest level of the CSCI, which is 1 (Figs. 4.11, 4.12).

Comprehensive city planning programmes are needed in these cities to improve the lives of urban dwellers. Streets where the needs of all users are considered and factored (ages, gender, economic status, modal means, etc.) are urgently needed in Conakry. Mobility must be multidimensional, easy, comfortable, and safe [37].
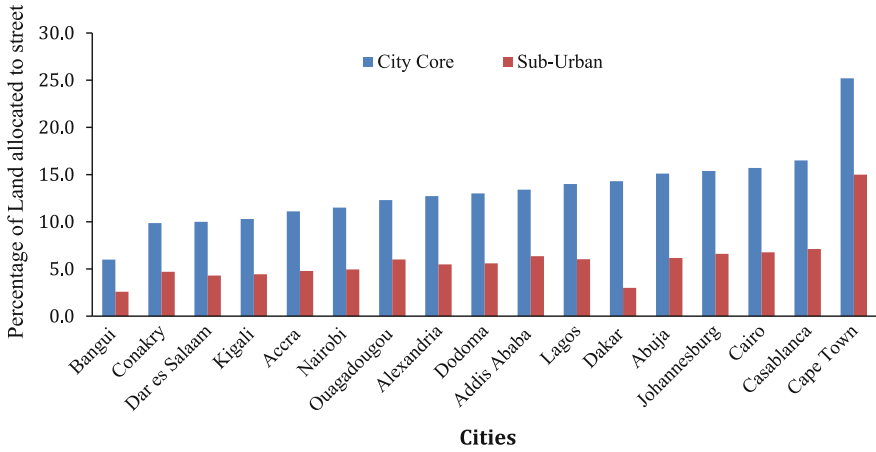
Fig. 4.11 Land allocated to street (LAS) in African cities. *Source* Figure prepared from Mboup G. et al. (2016). Smart city foundation—drivers of smart cities. In Vinod et al. (2016). Smart economy in smart cities, Springer

Fig. 4.12 Composite street connectivity index (CSCI)

4.4.2 State of Urban Mobility in Conakry

It is rightly recognized, in the Sustainable Development Goals (SDGs) adopted by United Nations' member states, that sustainable transport is crucial for urban economic development. One of the target of Goal 11 of the SDGs "*Make cities and human settlements inclusive, safe, resilient and sustainable*" is, indeed, to provide access to safe, affordable, accessible and *sustainable transport systems* for all, improving road safety, notably by expanding public transport, with special attention

to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons" [38]. In the SDGs and the COP 21, it is also recognized that transport is crucial for sustainable environment. It plays a key role in achieving commitments in the COP21 as a critical part of the climate change solution where it contributes to 23% of global CO_2 emissions. It can contribute to both reducing greenhouse gas (GHG) emissions and building economy wide resilience to the impacts of climate change [39]. Putting sustainable transport in global agendas is of importance for the African continent that has progressively been urbanized, and therefore will equally require efficient mobility of people, goods and services within and between localities.

"No aspect of urban form and travel has been more closely studied than the influences of urban densities on public transport ridership. It is widely accepted that high densities are essential for sustaining cost effective public transport services. The impact of densities on travel modes gained particular attention in the 1990s, in the wake of a global energy crisis and economic recession. Rail, with its high up-front capital costs and economies of scale, needs to attain a threshold density of trips, in order to cost less than accommodating the same trips by car or bus. The reliance of public transport on urban densities has prompted efforts to define the minimum density thresholds required to support successful public transport services. Cities need to average 3000 inhabitants per square km to support reasonably cost-effective public transport services" [40]. With low density, neither the investment required for BRT, nor that for rail, is likely to be viable because stations will lack sufficient proximate populations to generate demand. In spread-out cities, public transport has a difficult time competing with the private car for the middle and upper economic or walking for the urban poor. Public transport that is cost-effective can only be achieved through high urban densities and a large share of jobs and retail activities concentrated in the urban core, or in polycentric cities with multi-directional travel patterns [40]. In Conakry Peninsula, the population density exceeds this threshold indicating that Conakry transport problem is not associated to low density but to other urban form components such as a low coverage of street network, urban monocentrism, etc.

Infrastructure Development is one component of a smart metropolitan regional development. It is composed of several elements including transport, energy and ICT. Here, our focus is on the first element, which is transport. While transport data has been gathered for most cities in developed countries, information on transport is scarce in African cities, and when it exists it is poorly documented; metadata providing definition, method of measurement and sources of information is rarely available. The lack of reliable data on transport has held back the development of effective urban policies aimed to effectively tackle deficient transport systems in African cities. The most common available statistics are the distribution of trips by transport modes (large buses, minibuses, private cars, motorcycles, and walking). However, this information does not make distinction on the type of trips. Are they for going to work, to the health centres, to the school, to the market, or all together [41]. In the era of data revolution, this information must be processed, analysed in association with social, economic and demographic information and used to guide

transport policies and planning in an open platform accessible to all stakeholders including the public. This information will help to overcome transportation challenges in African cities through informed planning, real-time monitoring and management that take into account multidimensional variables beyond the transport sector.

Though the statistics may be from different sources, there is a common finding which is that in most sub-Saharan African cities, people have limited mobility choice in getting to work: either they ride minibuses or they use their foot. Data collected in Conakry show that the share of minibuses in the public transport exceeds 90%. Despite various efforts taken by national and local authorities to boost the formal public transport, it remains with a very low share in Conakry, less than 5% in the total public transport, which is heavily dominated by informal means of mobility. Most of the formal public transport sector is composed with few medium-sized buses that must follow a specific itinerary, but they are barely seen in the streets submerged with the informal motorized means of transport.

The situation of transport and mobility is particularly critical and weighs heavily on the economic performance of the city and on the quality of life of Conakry residents. This inefficiency of the transport system is the result of the combination of two factors: the very peculiar shape of the territory, a long and narrow peninsula, associated with a very strong polarization of the administrative and commercial activities. The location of the port at Kaloum and the traffic it induces in the peninsula also contributes to the asphyxiation of the system and the deterioration of traffic conditions [5]. No efficient transport system can be implemented without a change in the distribution of activities throughout the peninsula through the development of centrality and a good articulation of functions around each polarity.

Informal public transport

Considering the lack of capacity by the formal public transport systems to meet the mobility demand of the residents of Conakry, dominance of the informal sector operators remains irreversible. The informal transport sector, composed of small-scale economic activities with unregulated employment, is largely dominated by minibuses operated by private entrepreneurs It represents 95% of the public transport. It supplies small-vehicles with low investment and minimal public support, low-performance services that fill the niche between formal taxis and formal public transport. However, the minibuses as means of public transport come with enormous externalities that authorities must not overlook in the transport planning process. In this sector, most vehicles do not fit to be in the road technically and with respect to traffic rules and regulations (technical control, license, insurance, etc.). This contributes significantly to congestion, air and noise pollution and traffic accidents. In addition, passengers, particularly women are exposed to harassment from the bus operators and other passengers. Violence against women is common in the public transport sector [42]. In a city like Conakry where the formal public

transport sector is quasi absent, the role of informal transport in generating broader social and economic benefits must be assessed together with the costs entailed. Prohibiting informal transport is not a viable solution as it destroys jobs and blocks access to employment, but externalities must be assessed and reduced significantly. A combination of valuing the service and regulating them can be effective in managing related issues, such as traffic congestion, accidents and pollution.

Increased use of private cars hampers efforts to make Conakry a smart city

In absence of reliable public transport systems, households that can afford it, usually the upper middle class and the richest, possess private means of transportation or use taxis, which offer comfort compared to the public means of transport. The perceived advantages of convenience, privacy and status continue to make the private car an attractive means of transport in Conakry as in many African cities [43]. The growth of private motorized transport during the twentieth century had major impacts on the growth and development of the city of Conakry as many cities in developing countries. The rate of motor vehicle ownership in Conakry has significantly increased during these past 20 years, from 5% in 1995 to 13% 2014. The major factor behind the growth of car ownership in Conakry is at a cost that is becoming affordable for a growing number of people of the middle class that cannot tolerate the discomfort of the informal public transport and seek individual freedom. With the continuous urban growth, it is expected that Conakry will be an exclusive motorized city if the public transport is not reinforced and mixed neighbourhood promoted.

While private cars offer the convenience of individual choice, this advantage is traded for much more land being used for road space and parking. Cars' land consumption and infrastructure costs can be a significant part of a city's budget and this costs heavily subsidized by both drivers and passengers. Emissions of pollutants in Conakry seem to be higher than the thresholds defined by international standards. Estimates of safety costs from the World Bank show that in African cities these costs can exceed 2.7% of national GDP [44]. A city submerged with cars is prone to more accidents, which generate economic and human costs. Without adequate public transport systems in place, and good planning choices that increase connectivity and proximity, congestion, pollution and energy consumption will also increase exponentially with the growth in car ownership.

Two major impacts associated with low coverage of public transport and increased uses of private cars are traffic congestion and pollution. The monocentrism of the city of Conakry is a source of traffic congestion and an obstacle to smartness. The mobility in Conakry is heavily affected by the fact the city was conceived as a monocentric city where residential areas and workplaces are distinct, with the later concentrated in the centre of the city. Residential areas were also designed along economic class lines. This has led to social and economic fragmentation that disadvantage lower income group in accessing basic services and prevent social interaction and integration. This has impacted the traffic with every morning and evening people have to share a main street network to and from the downtown of Conakry.

Traffic congestion is a major indication of the disjuncture between land-use planning and transport systems. It not only exposes the limitation of a transport-oriented bias to mobility, but also reveals the inefficiency of land-use systems in a given city. Limited road capacity, in the face of growing demand for motorized mobility, partly explains deteriorating traffic conditions. Congestion has widespread impacts on the urban quality of life, consumption of fossil fuels, air pollution and economic growth and prosperity. Congestion accounts for significant percentages of the gross domestic product in many major cities as noted in World Bank studies from the 1990s. About 90% of the cost comes from the value of the time lost by residents, 7% from the fuel consumed and 3% from gas emissions. In addition to economic costs, congestion causes significant numbers of early deaths from respiratory illnesses, stress and physical and mental fatigue. It also degrades green areas, which, in turn, diminishes their carbon sequestration properties.

Walking—Key for Conakry smartness

In absence of affordable, reliable public transport, various options exist depending on level of economic conditions or purchasing power. Those that can afford it will own a car or ride a taxi, while those that cannot afford it, who constitute the majority, will use their foot. Those using their foot have limited opportunities compared to others that have access to public transport. They won't accept job where they have to walk very long distance, or if they accept job far away from their residence, they will encounter several days of absenteeism, and they end up by quitting the job. Despite lack of comparative data, it seems that the share of walking to access services remains the first option in Conakry due two main factors, namely: low coverage of public transport infrastructure and unaffordability of public transport for the poor where various needs compete. While in cities of developed countries, it is assumed that a walkable street is more attractive to people for various reasons and even defines the "liveability" of a city, in the city of Conakry walking is not a choice, but a necessity due to lack of other affordable transport alternatives.

Available information shows that 78% of residents of the city of Conakry walk to their place of work, to health centres, to schools, or to the market. However, the streets of Conakry are not designed for pedestrian use. First, the land allocated to the streets is low, only 10% in the city core and less than 5% in many sub-urban settlements. The streets are also narrow, not paved, and lack sidewalks; this result in competition for space with motorists, often exposing pedestrians to accidents. It is also noted that in many African cities, 95% of the city streets also have high pedestrian flows but only 20% have pedestrian footpaths [35]. In addition, streets in the suburbs are poorly connected with less than 40 intersections per square km. Lack of sufficient intersections make the street network of Conakry not friendly to pedestrians. It is demonstrated that for a street network to be well connected and walkable, at least 100 intersections per square km are required [45]. In areas such as Mototo and Ratoma, which are densely populated, there is no space left for mobility except very tiny streets where people have to squeeze through. In many settlements,

public transport services are accessible in few arterial streets where people have to walk several kilometres to reach them. During the raining season, the already limited walking spaces are flooded, forcing people to stay at home, losing many productive hours. This in turn has serious social and economic impacts on the city's economy.

Despite challenges, walking has enormous economic, social and environmental advantages. Conakry of the 21st century must be planned as walkable with affordable means of public transport. Walking is an enabler of social cohesion and environmental sustainability with enormous social, Economic and Environmental benefits. It is now recognized and advocated that walk is the most efficient means of mobility for environmental sustainability as expressed in global agendas such as Sustainable Development Goals (SDGs) and the COP21 in 2015, and the New Urban Agenda in 2016. In addition to its social and economic benefits, walking has a major advantage in reducing energy consumption, greenhouse gas emissions and pollution (air, water and noise) substantially, as it does not rely on fossil fuels unlike other modes of transport in cities. Furthermore, as walking requires significantly less road space and parking, it enables the preservation of natural habitats and open spaces. Walking also provides the daily physical activity required for a healthy lifestyle. Based on this, many motorized cities of developed countries have been changing their street planning and designing, and promoting public transport in order to reduce private motorized use and boost walking and cycling. With the 60% of people that are already walking in city, Conakry is indeed in a good position for a healthy society in a sustainable environment. However, in order to sustain this advantage, it is high time to give to pedestrians their right share in the transport infrastructure. Providing adequate infrastructures to pedestrians is cost-effective considering the enormous benefits from walking.

Integrating public transport, walking and cycling along the urbanization of Conakry

Conakry does not benefit from the multiple advantages of high density due its unplanned urban growth and land expansion. While the advantage of a high density settlement is to ease accessibility, reduce cost of provision of basic infrastructures and other urban services, reduce erosion of natural resources, lower business costs and improve social equality, in Conakry none of these benefits are present or they are little. Considering the high population density in many unplanned settlements of Conakry where the urban growth still high (more than 2% annual growth), it is urgent to develop and implement city extension at the fringes of the built-up area. The extension of the city of Conakry will specifically host inhabitants of densely populated areas and settlements built in flood prone areas. Every year, flooding causes enormous economic, social and environmental damages and losses among people and communities. With the climate change associated with rise of sea level, there is urgent to operate a city extension that was supposed to be in the 20th century when the density is still manageable. Planning an extension requires vision and commitment [46]. National and local authorities have already identified areas

where the extension of the city of Conakry will be implemented as the part of the Grand Conakry Vision 2040.

4.5   Urbanization, Economic Growth and Metropolitan Regional Development

Conakry is a hub of economic activities linking local, regional and global economies. Today, it has an added advantage associated with its high population density and its youthful population, two important drivers of economic productivity and growth. One of the components of a Smart Metropolitan Regional Development is Economic Development, which is analysed in this section.

4.5.1   Urbanization and Economic Growth

The Conakry Peninsula contributes 40 to 60% to the national Gross Domestic Product (GDP) [47]. Up to nine out of ten national civil servants, and from 70 to 90% employees in national's trade, transport, banking and industrial enterprises are in Conakry. Though the Conakry Peninsula had been administratively divided in five municipalities, in reality most of the formal economic activities are concentred in the municipality of Kaloum, other municipalities such as Mototo and Ratoma acting as suburbs. The municipalities of Mototo and Ratoma remain haunted by the early spatial and social division; they are not well planned, and they lack sufficient land allocated to streets, other public spaces, basic infrastructure and security of tenure.

Though Conakry Peninsula is engine of national economies, association between urbanization and GDP around the world shows that the Conakry Peninsula as many African cities perform much less than its counterparts in other regions. In the Republic of Guinea, urbanization has not led to expected economic growth as shown in Fig. 4.13, with Guinea below the curve of association between GDP per capita and urbanization.

While countries in Asia such as China, Indonesia, Malaysia, Thailand and Vietnam and in LAC such as Mexico, Costa Rica and Argentina display an increase in GDP per capita associated to high urbanization rates, a similar association between GDP per capita and urbanization was not observed in most sub-Saharan African countries among them Senegal, Guinea, Togo, Liberia and Burundi. In most of African countries, capital cities were not able to produce and distribute wealth nation-wide. Conakry has not been able to fully transform its large population in terms of economies of scale and agglomeration economies as many Europeans and American cities did more than 50 years ago, and LAC cities and Asian are recently doing. The low productivity of Conakry lies to several factors
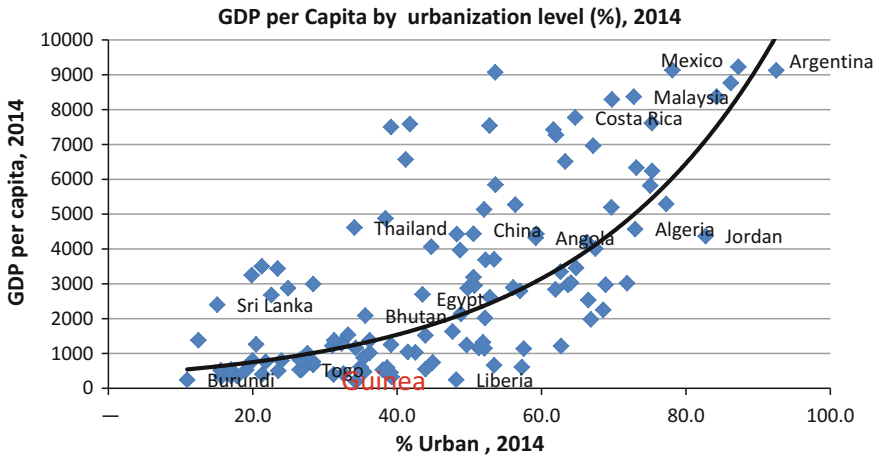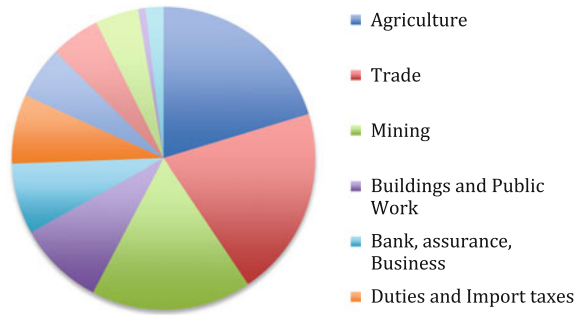
Fig. 4.13 GDP per capita by urbanization level (%), country with GDP below US$15,000. *Source* % urban (UNDESA), GDP per capita (World Bank)

including those spatial and mobility planning presented in previous sections as well as other factors associated to urban legislation and governance and financial capacities. Unbalanced urban system, unplanned dense settlements without basic services, poor street connectivity, and poor transport infrastructures impeded Conakry economies of scale and agglomeration potential, and create scale and agglomeration diseconomies.

Before the political normalization that took place in December 2011, Guinea experienced great political, economic and social fragility. From 1987 to 2007, the annual growth of GDP per capita was 0.9%. Moreover, GDP per capita has changed at a much slower pace since 2000. Between 2002 and 2005, the growth of the Guinean economy has average of 2.8% per year. Based on population growth of 2.2% per year, the resulting improvement in purchasing power is only 0.6% per year, which is a performance well below the target of 5% growth of the Poverty Reduction Strategy Programme (PRSP) [48]. In the national budget, the priority sectors are: Education (11.6%), Habitat and Social Affairs (11.2%), Health (4.9%), Road Infrastructures (8.7%) and rural development (24.7%) [14]. Thus, despite its considerable economic potential, Guinea is ranked among the least developed countries (LDCs) with a poverty rate that affects nearly 55% of the population in 2009 against 49% in 2002 [49]. The political, economic and social situation has particularly deteriorated from 2007 to 2010. But since December 2010, the country has embarked on the path of normalization, after a courageous and difficult democratic transition.

Guinean cities are essentially tertiary cities, based on trade and administration and where the informal sector occupies a prominent place. There is no correlation between the administrative hierarchy of cities and their economic role, nor between

Fig. 4.14 12 distribution of GDB by economic sectors, Guinea, 2012. *Source* Data from National Institute of Statistics, Guinea 2012

- Agriculture
- Trade
- Mining
- Buildings and Public Work
- Bank, assurance, Business
- Duties and Import taxes

urban services and industrial production functions. The industrial employment rate remains below 5% everywhere, even in mining towns. Agriculture is important with 20 to 25% of jobs in regional cities but more than 30% in smaller cities [14]. When we consider the non-agriculture sector, trade, mostly informal, will represent quarter (26%) of the employment followed by mining (22%). Bank, assurance and other financial institutions represent 9.4%, similar to duties and important taxes (9.3%). Transport and Communication have a share of 7.0%, similar to public administration (6.6%). Manufacturing represents only 5.8%, followed by the sector of electricity, gas and water (1%) (Fig. 4.14).

Industry in Conakry is confronted with several challenges that include low production levels, inadequate competitiveness of the local market, lack of capacities of industrial firms to upgrade their production systems, geographical and structural weakness of the industrial fabric. In operational terms, initiatives concerning partnership between the State and the private sector are still minimal, particularly with regard to the promotion of entrepreneurial initiatives, the development of innovation through research application, the creation of integrated competitiveness poles and the training of future champions of the different sectors and the development of venture capital. The shortage and unreliability of power supply and the weak infrastructural platforms cripple the performance and competitiveness of industries, causing substantial additional costs. In addition to these drawbacks, industrial production suffers significantly from its strong concentration in the Conakry area as mentioned above, hampering the potential of provincial economic zones, as well as from lack of diversification and a system of product quality certification. Against this background, industry has not paid attention to the need to protect the environment as a general concept, but also as a strategy to improve their productivity and competitiveness [50].

Unemployment rates are particularly high in Conakry with a level 13.6% compared to less than 4% in all other regions. Conakry has not been able to satisfy the employment demand, particularly from young people (Fig. 4.15). The Conakry job market is predominantly informal. In addition to that, due to a deficient urban mobility, Conakry has not been able to create conditions for specialization. While urban agglomeration allows for job specialization, efficient market transactions and
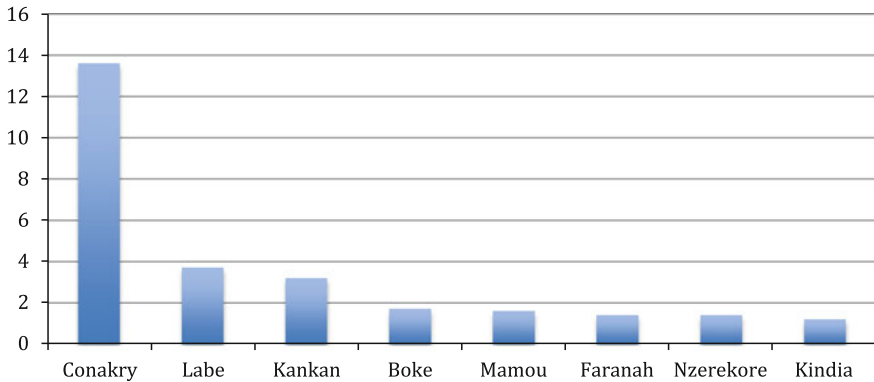
Fig. 4.15 Unemployment rates, Guinea, 2012. *Source* Data from National Institute of Statistics, Guinea 2012

knowledge diffusion, if concentrated growth is not well planned—such as the integration of urban growth with efficient public transit investments, the resulting economic benefits tend to erode. Agglomeration diseconomies—i.e. the inefficiency and loss resulting from poorly planned concentrations—are expressed in the form of lost labour productivity from extreme traffic congestion, increasing air pollution and an overall decline in the quality of urban living [51]. This is the case in Conakry as in many African cities with poor connectivity leading to disconnected settlements.

For cities to act as integrated labour markets and match jobs seekers and employers, they also need to make employment spatially accessible to all residents. The Conakry metropolitan region has failed to do so. Inaccessibility to public transport, indeed, limits the access to formal jobs for many people that rely on minibuses or their foot. For instance, it is noted that within 45 min, only 10% of minibus riders or pedestrians can access to formal job. Even with 60 min, the figures remain low with only 10% of pedestrians and 20% of minibus and pedestrians can do it. This means that people who count on their foot or on minibus are excluded from several formal jobs, unless they accept to be in the minibus for hours or to walk hours in order to reach their work place as illustrated. Though most people with cars (96%) can access their formal workplace within an hour, this figure drops to 77% when the traffic is congested, particularly during pick hours when everybody is rushing to reach their workplace [52]. This shows poor street connectivity associated to poor transport infrastructures limit job opportunities among the urban poor. They cannot afford neither the bus fare nor to have a private car. They cannot also relocated to where jobs are due to high cost of rental proprieties.

Economic inequalities are also very high in the Conakry Peninsula leaving municipalities with high unemployment and low access to basic services unable to afford many subsistence needs as illustrated in Table 4.3.

Table 4.3 Distribution of neighbourhoods of the City of Conakry according to degree of poverty

Degré de pauvreté	Communes	Quartiers
Degree of Poverty Very poor neighborhoods	Kaloum Dixinn Matam Matoto Ratoma	Coronthie, Fotoba, Koulewondy Dixinn port, Kenien, Carriére, Mafoco centre, Coleah cité Dabondy 1, Dabondy 2, Dabondy ecole, Dar-es-Salam 2, Gbessia cité, Matoto centre, Yimbaya école Kaporo centre, Symbaya gare, Sonfonia gare, Wanidara
Poor neighborhoods	Kaloum Dixinn Matam Matoto Ratoma	Boulbinet, Sandervalia, Tombo Bellevue école, Cameroun 1, Dixinn centre 1, Dixinn centre 2, Dixinn gare, Dixinn mosquée, Hafia 1, Hafia 2, Hafia minière, Hafia maosquée, Landreah, Minière cité Bonfi, Coleah centre, Domino, Imprimerie, Lanseboundji, Madina mosquée, Matam, Touguiwondi Cité de l'air, Dabondy 3, Dabondy rail, Gbessia centre, Gbessia cité 3, Gbessia école, Gbessia port 1, Gbessia port 2, Matoto Khabitaye, Matoto marché, Sangoyah marché, Sangoyah mosquée, Symbaya 2, Tanene marché Dar-es-Salam 1, Hamdallaye 1, Hamdallaye mosquée, Kipe, Kobayah, Lambandji, Nongo, Ratoma centre, Sonfonia centre, Yattayah
Neighborhoods with moderate living conditions	Kaloum Dixinn Matam Matoto Ratoma	Almamya, Kassa, Manquepas, Sans fll, Temenetaye Camayenne, Dixinn rail gare Bonfi marché, Boussoura, Hermakonon, Madina centre, Madina cité, Madina école, Madina marché, Mafanco, Matam lido Dabompa, Gbessia cité 1, Kissosso, Tanene, Yimbaya permanence, Yimbaya tannerie Hamdallaye 2, Kaporo rail, Kotoma 1, Koloma 2, Ratoma dispensaire, Taouyah
Wealthy neighborhoods	Kaloum Dixinn Matam Matoto Ratoma	Bellevue marché Behanzin, Symbaya 1, Tombolia

Source Republic of Guinea and Royaume du Maroc, 2017. Assistance technique pour la mise en oeuvre du projet d'assainissement de la ville de Conakry

The Population of Conakry was classified according to their degree of poverty (Table 4.3), from the highest living standard to the poorest living standard. Overall only one third of the population of Conakry has a decent living standard (32.7%); the remaining two-thirds are poor or very poor (67.3%). Extreme poverty, characterized by multiple deprivations, affects one fifth of the population (19.4%). Poverty is particularly high in Mototo, Ratoma and Dixin where the level exceeds the two-third level. In all municipalities, the majority of population are poor. A widening urban divide between social groups has also been underscored in the Grand Conakry Vision 2040 [5].

4.5.2 The Economics of Urban Land—The Hidden Assets [53]

4.5.2.1 The State of Land Tenure

The smartness of Conakry Peninsula has also been long time hampered by weak institutions and laws holding back various factors of the smart city foundation, making informality the norms in many sectors starting with the city foundation surrounded by informal settlements with irregular land tenure. Secure tenure goes beyond protection against eviction and includes economic and financial advantages. *Tapping in the Triangle of Economic Productivity—People, Land & Infrastructures* will create sustainable, inclusive prosperous and resilient cities. Cities are built by people; with their concentration offering economies of scale and agglomeration starting from their land and housing assets. With functioning institutions and laws, land and housing assets can contribute to the planning, management and provision of services in settlements. However, in absence of functioning institutions and laws providing legal propriety rights, as observed in Conakry, most of these assets remain dead investments sheltering only people. To tap into the potential of high densities, the Conakry Peninsula must formalize its land system, which will be the driver of many other components of its foundation such as streets and public spaces, provision of basic infrastructures such as water, sanitation and energy, and waste management. It is urgent that national and local authorities recognize the wealth of their citizens and involve them in the planning, the building and the management of their city. No city can claim to be sustainable, inclusive, prosperous and resilient, when the wealth of its citizens is not fully taken into consideration in the economy. Conakry as most African Capital cities are not, however, fully benefiting from its land assets due to the fact that most of its land is considered as irregularly acquired and lacks legal ownership document such as a title deed.

The land tenure system was not able to synchronize with the population growth of Conakry due to lack of implementation of urban plans. Finally people settle first where there is land, and then proceed later for regularization that will never happen in most cases. These settlements are no longer only in the suburbs but also in the city core of Conakry as observed in Kaloum and Dixin as well as in other municipalities. The indigenous people, regrouped in families, progressively abandoned agriculture and sold their land to whoever can pay. First they subdivided land in plots with the help of a geometer. In this case, the emphasis is more on the number of plots than in streets and other public spaces. However, they could only provide sale documents showing buyers and sellers. However, certain buyers can negotiate and have legal documents in an illegal area. This opens the door for corruption, lack of transparency, and poor recording. Since this situation seems comfort the officials, there was little or no interest to improve it.

Possession of ownership or tenancy document is low in Conakry where, less than half of households had a proof of legal ownership: title deed, sale certificate, power bill or other documents [54]. The problem of land is particularly complex in

Conakry (as in the rest of the country) because of two major obstacles: (a) the effects of the reforms, and in particular the content of the Land and Estate Code of 1992 with the reintroduction of customary law alongside modern law; (b) the absence of the Guinean State in the control of land-related regulations and the "laissez-faire" policy that has prevailed for years [5]. Measures to reduce the risk and stress associated with lack of documents and fear of eviction are based on recognizing and respecting a plurality of tenure systems, including intermediate forms of tenure arrangements and alternative forms of land administration and land records [55]. The legal institutional framework in a given country or city plays a key role on various elements of security of tenure such as acquisition or adjudication which is the process of final and authoritative determination of the existing rights and claims of people to land.

4.5.2.2 Financing Infrastructure Development and Economic Development Through Smart Land Tenure

Having legal land ownership documents has various social and economic advantages including access to the financial and economic market as illustrated by de Soto. De Soto argued that granting titles to the poor would liberate the plots they occupy and transform them into capital. This, in turn, could be used as collateral for loans to jumpstart their businesses, or improve their houses, among other gains that increase their quality of life. At the community level, regularization of land tenure will help the municipality to legally collect various taxes that can be used to improve basic infrastructures such as connection to water, sewerage facilities, energy sources and waste management facilities. This would also allow people to fully participate in the development of their communities at the policy as well as the implementation level instead of seeing proprieties as dead investments serving only for shelter [56]. Though having a title dead does not necessary lead to secure a bank loan; it may not be sufficient in itself to animate the dead capital interred in land and property, particularly in countries where banks lend only to workers with high wages and a stable job, as it seems happen in some countries covered in de Soto study. However, families with title dead may be likely to invest either to improve the quality of their homes or to increase their size. It is also important to note that land tenure goes hand and hand with urban planning [57]. Without an accurate mapping, legal title dead cannot prevent land disputes as it often occurred in African cities.

While there is argument against the de Soto theory in poor settlements, in Conakry regularization of land tenure will work for many middle and upper income households that have not been able to use their property as collateral due to lack of legal ownership document. Another important group land regularization will benefit is the Guinean from the diaspora who usually send money to their family and build houses in Conakry. Most of these houses are built in irregular settlements. Among

the Guinean of the diaspora, certain have a high desire to return home, but they have not save enough to do so, and they cannot use their houses as collateral and start a business in Guinea. No choice, even those they reside in Conakry cannot get a title dead, what about those that just come to visit their family for a month or less. These are not the poor as described in the de Soto book, they have already the value of savings as underlined by the money they sent to their family in a monthly basis.

Urban land is a vital economic asset, and asset transactions are viable only where purchasers can rely on enduring extra-legal documentation of ownership. A formal market offers purchasers legal protection with transactions adequately recorded in land administration book; it also generates public good with accurate valuation [58]. Transparent property rights to urban land are a precondition for formal land markets. When these systems pose barriers to urban land access, they impede the consolidation of plots and the evolution of land use. Land transactions are long, costly, and complicated in Conakry as in most African cities [59]. Such market constraints reduce the collateral value of structures, giving developers little incentive to invest in residential height. In such a condition transactions are made through informal arrangements [60].

It is also noted that due its rapid growth, land prices are high in the city of Conakry but benefits less to the infrastructural development of the city. It does not create revenues for the cities as illustrated in the city income-expenditures sheet. In cities of developed countries, land-based financing has significantly contributed to urban investment. Taxes on land use will reduce the high level of inactive land in Conakry. Considering that they are paying taxes on the land, landowners will either develop their land in its most profitable use or they will rent/sell it. Improved valuation of land and properties closer to their market value, deepening the tax base; Improved enforcement of land and property taxes on a larger number of owners, broadening the tax base and; monetization of underused public land [61]. This will require functioning institutions in a transparent manner with inclusive, documented property rights using standardized and objective methods of land valuation. Good land governance and administration where corruption does not have a place will make trusted institutions and will encourage landowners to register their properties considering the high returns for them and for their community. Due to limited revenues of the city of Conakry, it is high time to tap to the potential capital of land through the regularization of land tenure.

Large infrastructure projects require huge investments. However, like any large structures, they depreciate very slowly over decades or even centuries [62]. The central government transfers on which Conakry often rely will not suffice to finance all infrastructures required to take advantage of the economies of scale and agglomeration that Conakry can offer its large population of about 2 million inhabitants with high density of over 4000 inhabitants per square km. Therefore national and local authorities should explore various financing options for infrastructure development. The costs of developing housing, infrastructure, and industrial premises must be coordinated with land markets and land use regulations in

order to fully take advantage of the economies of scale and agglomeration of the city of Conakry. This calls for the formalization of the land tenure, which, in turn, will increase the land values that can be used to contribute to the development of basic infrastructures such connection to water, sanitation, drainage, solid waste management and streets. For instance, in Conakry due to lack of municipal finances most municipal street networks are not paved. Municipalities with formal land system have the large proportion of paved streets compared to others without formal land system.

Secure tenure goes beyond the legal character; it attracts investments as illustrated by the level of provision of infrastructure in municipalities considered as legal settlements comment to others considered as informal settlements. These municipalities also enjoy health centres and school facilities. They also attract the financial market because they have a legal urban plan with a sufficiently documented cadastre system. In most irregular settlements, there are few or no paved streets, and the few streets they have do not have light. Lack of documented urban plans affects the financial as well as the land market. It is noted that capacity and resource constraints are the main reason infrastructure in most municipalities have been lagging behind. In absence of formal land system, a settlement is trapped into poverty. With this, there is no doubt that wealth is associated to formal land system. Let make secure tenure work for people and communities. Conakry is expected to reach 5 million inhabitants in 2040 with the Grand Conakry 2040. This will propel new demand for infrastructure such as water, sanitation, sewerage, waste management and streets among others. To meet this demand, land transactions must be eased with transparent efficient land law, administration and governance with documented land and property rights; documented guidance of land valuation and prices and; coordinated land use and urban planning. Land tenure goes hand and hand with urban planning. Urban planning supported by accurate demarcation of public and private uses are of importance [57]. Without an accurate mapping, legal title dead cannot prevent land disputes as it often occurred in African cities. In Conakry, it may take several years before regularization, particularly when it is bought informally. Formal land Registration will ease transactions and boost economies of scale and agglomeration.

It is also necessary, in Conakry, to proceed with the renovation of the degraded habitat of municipalities. But this renovation can only give satisfactory results if it is part of an urban planning and concerted development project between the State, the city of Conakry and municipalities, on the one hand, and the private sector, on the other hand. In this system, the private sector will occupy a central place in the construction or rehabilitation of buildings. The public authority will be the first developer of equipment and regulation. The private sector will thus promote, and renovate buildings, for which it will provide financing through the channels it has itself identified, in consultation with the public authorities. An urban land-use law, adapting the rules of town planning and development, will put the land in the service of the renovation program. Sectors of social mix, with a minimum of 25 to
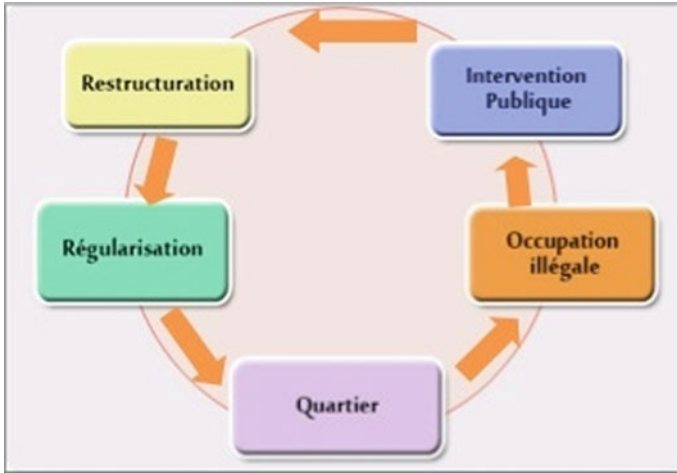
Fig. 4.16 Cycle of regularisation of irregular settlements. *Source* Vision Habitat 2021

30% of social housing, will be included in this renovation program. A functional mix (greater diversification of urban functions) will be encouraged as expressed in the Conakry Vision Habitat 2021 [49] (Fig. 4.16).

The State has a major responsibility in the implementation of land policies: (a) as a regulatory authority, it must facilitate access to an abundant land base, and a controlled cost, especially for the public operators in charge of the application of housing and city policies and major structuring projects; (b) as legislator, it determines the conditions of application of prerogatives of public authority (expropriation and declaration of public utility) and operational procedures, which must be justified by the notion of public interest, which must, in all circumstances, be indisputable; and (c) regarding public finances, it has the capacity to perceive the benefits of taxation on built and undeveloped land, traditionally oriented to the benefit of local communities [5]. The capacity of the State to conduct a land policy is decisive to enable the authorities to influence the areas of urban development at different scales: (a) at the level of national planning for the management of major infrastructures roads and railways, the programming of equipment of national interest, and the preservation of large natural reserves; (b) at the level of metropolitan land planning, with the location of new settlements, and structuring large agglomeration infrastructures; (c) at the level of local town planning, through the ability to conduct punctual development or urban restructuring operations based on clear and indisputable procedures.

4.6   Towards a Smart Metropolitan Regional Development

Most of the components of a Smart Metropolitan Regional Development (SMRD) are composed of several simple sub-components. Put them together to track progress on the overall objective of the SMRD will require the development of composite indices using sophisticated multi-level statistical analysis including Principal Component Analysis. The complexity of a composite index is the fact that it is strongly influenced by several factors including: the normalization, the standardization and the degree of association between variables and the number of variables that compose the index. An index can also be conceptualised differently using different variables. This calls for caution when interpreting a composite index. For instance the Quality of Life is conceptualised and measured in different ways across studies. The Human Development Index includes indicators of health and education, alongside an economic component (Gross Domestic Product or GDP); the Legatum Prosperity Index considers quality of life to be multidimensional, including both wealth and wellbeing; The Economist Intelligence Unit's Quality of Life Index links life satisfaction to health, family life and community life; and the OECD's Well-being Initiative has two dimensions: 'material living conditions' and 'quality of Life' [16].

In our study, a smart metropolitan regional development is viewed as a sustainable, inclusive and prosperous metropolitan regional development that promotes a people-centric approach based on three core components—Smart Metropolitan Region Foundation, Information and Communications Technology (ICT) and Smart Institutions and Laws, which are the pillars of the other dimensions of a smart metropolitan region: Infrastructure Development, Environmental Sustainability, Social Development, Social Inclusion, Disasters Exposure, Resilience, and Peace and Security. **Infrastructure Development** complements the basic infrastructure services under each smart metropolitan foundation and extends to actual investment and advancement of services such as transport, ICT, industrial energy, education, health, etc. **Environment Sustainability** is comprised of elements of energy, transport, building and pollution. **Social Inclusion** includes aspects of participation in decision-makings as well as equal opportunities for growth and prosperity. **Social Development** encompasses elements of education, health, public space, social inclusion and social capital. **Disaster Exposure** incorporates elements of mitigation and adaptation to various disasters such as flooding, droughts, storms and earthquakes. **City Resilience** is composed of elements of city foundation, environment, social capital, and social development. **Peace & security** included the elimination of all forms of discrimination and violence and conflicts, including domestic violence, violence in public places, crime, armed conflicts, terrorism, etc. An insecure metropolitan region limits opportunities for investment and economic growth and cannot be a smart metropolitan region.

The city of Conakry was included in the development for three indices published by the UN-Habitat and conceptualized and further developed by Mboup G. (2012, 2013 and 2014). Those indices include: the City Human Development Index, the

City Prosperity Index and the urban form-based City Prosperity Index integrating the Composite Street Connectivity Index. This section will take it further for the development of the Smart Metropolitan Regional Development Index.

4.6.1 Urbanization and Human Development

4.6.1.1 Urbanization and Education

A second priority axis of the Guinean Poverty Reduction Strategy (PRS) concerns education. Progress has been recorded during the most recent PRS evaluation period: between 2002 and 2005, the Gross enrolment rate has increased from 72 to 79%. This exceeds the PRS target (70%) but remains below that of PEPT 'Education for All Program' (81%); the girls' enrolment rate has reached 73%, which is 10 percentage points higher than of the PRSP, with the ratio of girls to boys going from 0.74 to 0.79. However the regional results remain very contrasted: the Conakry Gross enrolment rate is 128%, much higher than its levels in other regions such as Labé where it is only 60% [14]. The city of Conakry also has the highest literacy rate among the adult population 65.4% as recorded in 2012 against less than 35% in all other regions (Fig. 4.17).

Despite the overall progress recorded in the education sector, some structural problems persist, such as: (a) Insufficient coordination between educational administrative institutions; (b) low pro-poor educational policies towards the disadvantaged regions; (c) high repetition rate indicators estimated in 2005 as 23% in primary school, 27% in middle school and 19% in high school; (d) deficit in school infrastructures: annual needs in classrooms are over 1200 rooms while the average annual built classrooms is 345 rooms; and (e) lack of training of teachers [14].
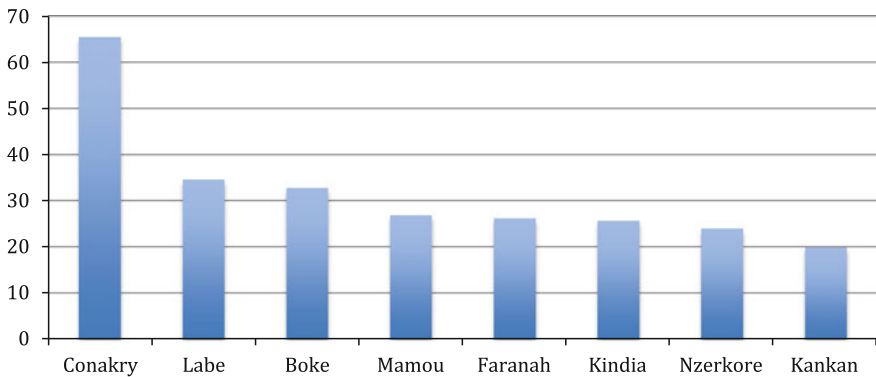

Fig. 4.17 Literacy rates, Guinea, 2012. *Source* Data from National Institute of Statistics, Guinea 2012

4.6.1.2 Urbanization and Health

A healthy population is critical to realizing economic growth through increased productivity [63]. Healthy workers are more productive, bringing greater income to families and higher levels of economic growth for nations. The Demographic and Health Surveys (DHS) held in Guinea in 1999, 2005 and 2012 show a constant progress in access to health services in Guinea during the past 15 years. Until 2000, access to health services was very limited and infant and child mortality rates were consequently high. With a steady improvement in health coverage, enhanced with the Millennium Development Goals (MDGs) with its Goal 4, 5 and 6, the improvement was accelerated during the 15 years of the MDGs. There is no doubt that improvement in health is significantly contributing to the Conakry smartness. Children born in Conakry have more access to health services such as antenatal (by their mothers), delivery cares and immunization than those born in other cities, town and villages of Guinea. While the child immunization coverage (with all vaccines) is estimated at 44% in Conakry in 2012, in some regions such as Faranah, Labe and Mamou, this level is less than 30% (29.4, 23.9 and 19.3% respectively. While in Conakry the quasi-totally of children had received at least a vaccine (99.7%), in some regions such as Labe and Mamou many children had not received any vaccine (23 and 19% respectively).

Significant decline of infant and child mortality rates along the urbanization of Guinea—In the context where access to health services has significantly improved, mortality has also significantly decreased, particularly among children under five years old. During the period of 1997–2012, the under-five mortality has decreased from 152 per 1000 to 123 per 1000. The decline of mortality rates has also been observed in other parts of Guinea, but to a lesser extent, making the figures of Conakry much better than the national figures. While the under-five mortality rate is estimated at 70 per 1000 in 2012 Conakry, in other regions this level is higher than 100 per 1000, with the highest recorded in Kankan (194 per 1000) followed by Faranah (163 per 1000) and Labe (141 per 1000) (Fig. 4.18).

4.6.1.3 The City Human Development Index

Despite its potential to be sustainable, inclusive, resilient and prosperous, Conakry has not be able to be the engine of the economic development of the Republic of Guinea as illustrated by its low City Human Development Index (CHDI) compared to other African cities. Among the cities analysed here, only Conakry, Antananarivo and Monrovia have a CHDI, which is equal or lower than the national HDI. This is partly due to the fact that Conakry urban agglomeration's development has been hampered by its weak city foundation characterised by proliferation of unplanned settlements, poorly served in basic services and without land tenure security (Fig. 4.19).
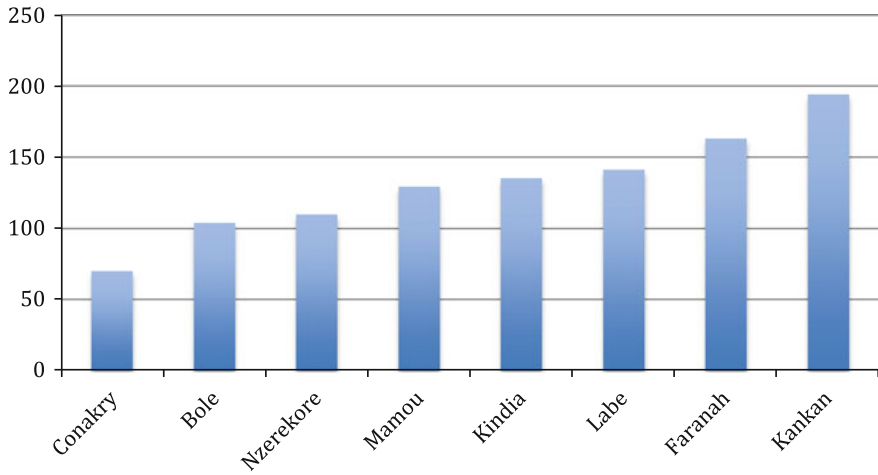
Fig. 4.18 Under-five mortality rates (per 1000). *Source* Computed from National Institute of Statistics, Republic of Guinea, 2013. Demographic and Health Survey and Multiple Indicators Cluster Survey (DHS-MICS, 2012)

Fig. 4.19 City HDI and Country HDI, 2014. *Source* Mboup G (2016). Smart social development key for smart economy. In Vinod K. et al. (2016). Smart economy in smart cities, Springer

Though cities like Conakry are engine of economy growth, they need to be driven smoothly in an efficient administrative and governance environment. Thinking that having a large city and a high density is sufficient to produce economies and scale and agglomeration, is a simplistic view because they are many other factors that need to be present for urbanization to produce wealth and prosperity in general. In Conakry like in many African cities those ingredients are lacking leading to various negative externalities. Finally instead of enhancing

economies of scale and agglomerations, Conakry as many African cities encourage diseconomies. Youth non-employment is high, and young people from impoverished urban areas can only find jobs in the informal sector with no social security coverage, paid and parental leave, retirement, and unemployment benefits. The high rate of non-employment of young people in Conakry as in many African large cities is reason for concern; the lack of decent, sustainable jobs promotes a sense of displacement in the general youth population and often leads to crime, under-development, and a cycle of poverty. Frustrations accompanying long-term unemployment among groups of urban young men may feed political and ideological unrest and provoke violence.

4.6.2   Urbanization and Environmental Sustainability

The Study for the Review of Coastal Town Planning Schemes of Guinea is a component of the Project "Strengthening Resilience and Adaptation to the Negative Impacts of Climate Change in Coastal Vulnerable Areas of Guinea-RAZC". The aim of the study is to establish that the urban planning management tools in Guinea integrate or not measures and actions on the adaptation of coastal cities to climate risks. Regarding the Conakry's development plan, the options selected include: (a) the creation of a large network of traffic corridors providing links between urbanized areas; the establishment of multi-functional centres playing the role of urban poles linked to the peninsula; (b) the organization of housing areas around small sector centres that will be served by cross-roads, etc. These measures can help protect people and their property from the effects of climate change as they can induce decongestion of the port centre located in Kaloum and better distribute urbanization throughout the city's territory and thus minimize the impacts of natural disasters such as floods, heat waves and possibly the consequences of extreme events such as hurricanes. The urban plan of Conakry also recommends land management actions that are likely to fight against the anarchic use of space and urban sprawl, that promote increase in energy consumption, and floods; Conakry being one of the twenty most exposed cities because of its geographical location, and high population density. In-depth investigations and highly targeted proposals and rigorous regulation are needed to deal with potential natural disasters and protect people, infrastructure and superstructures. The accelerated degradation of the environment in Maritime Guinea is due to this important population growth, anarchic urbanization and uncontrolled urban sprawl.

The coastal territory of the Greater Conakry metropolitan area is an extremely fragile environment that is also under extremely high anthropic pressure. In particular, the mangrove areas surrounding the peninsula are particularly fragile and are continuously deteriorating. These impacts are the result of the increase in urbanization in these areas. Marine environments are also extremely degraded due to the pollution generated by discharges of domestic and industrial wastes. The shoreline is often used as a rubbish dump for domestic and industrial waste and as a

wastewater receptacle, causing biological and chemical pollution of the water and the parasitic and bacteriological infestation of living resources. These areas are fundamental to ecosystem equilibrium: the mangrove is a breeding ground, nursery and habitat for several species of fish, crustaceans as well as a place of refuge. Moreover, it constitutes a natural barrier that protects the coasts from marine erosion [5]. To these anthropogenic threats are added those related to climate change and rising water levels.

The proliferation of informal sectors also has led to the anarchic development of economic activities, industries and residential settlements. Growing industries located in or near the city, are key resource users as well as sources of pollution, waste, and greenhouse gases emissions. High use of informal modes of transport and private cars also contributes significantly to congestion, air and noise pollution.

4.6.3 Urbanization and City Prosperity

The City Prosperity Index (CPI) published by UN-Habitat in 2012 under the coordination of Mboup G includes various indices and indicators that are relevant to urban areas, and important for prosperity-oriented public policy-making. The first version of CPI published in 2012 was based on five dimensions: Productivity, Quality of Life, Infrastructure Development, Environmental Sustainability, and Equity and Social Inclusion [64]. In 2013, the CPI was revised to include the urban form dimension measured by street connectivity [65].

The resulting CPI values can be regrouped in six distinct brackets that range from cities with 'very solid' prosperity factors (CPI of 0.900 or above) to those where those factors are found to be 'very weak' (CPI below 0.500). The city of Conakry was classified among the cities with very weak prosperity factors. Cities in this bracket feature contrasted patterns among the sub-indices in the CPI. For some, the dispersion of index values across the 'spokes' reflects institutional and structural problems. For others, the five dimensions of prosperity do converge, only at very low values, a hallmark of dysfunctional systems, institutional failures, sluggish economic growth as well as widespread poverty and destitution [64]. In this group, much remains to be done there in terms of quality of life, infrastructure and environment in most of the cities in this bracket. Production of goods and services is still too low, a reflection of underdevelopment. Historic structural problems, chronic inequality of opportunities, widespread poverty, inadequate capital investment in public goods, and lack of pro-poor social programmes are critical factors behind such low degrees of prosperity. Various cities/countries from this group have a recent past marred by conflicts, political instability or economic crisis such as Monrovia (with a CPI of 0.285), Antananarivo (with a CPI of 0.446) or Conakry (with a CPI of 0.416). In all three cities, the city product is very low, 0.048, 0.133 and 0.171 respectively.
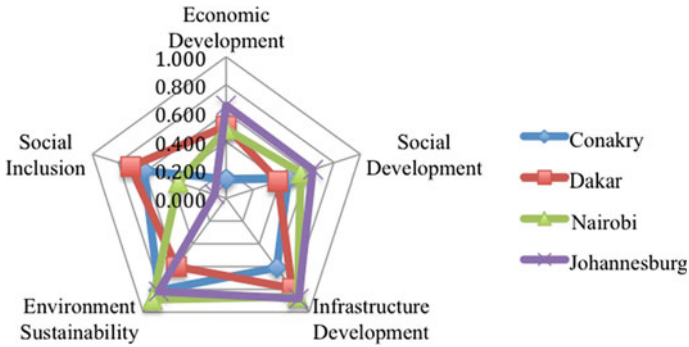
4.6.4 Towards a Smart Metropolitan Regional Development

Among the components of the Smart Metropolitan regional Development, five have
been part of the City Prosperity Index (CPI): Productivity, Infrastructure develop-
ment, Environmental Sustainability, Quality of Life and Social Inclusion.
The SMRD index introduces other components relevant for sustainable urban
development: Disaster Risk Reduction and Resilience, Peace and Security,
Institutions and Laws; It also expands productivity to Economic Development,
Quality of Life to Social Development, and make the distinction between
Infrastructure Development and Basic Infrastructure. It also introduced the concept
of city foundation built upon three dimensions: urban planning, land policies and
basic infrastructure. It also introduces ICT at the centre of the SMRD along with the
City Foundation and Institutions and Law. Considering that the CFI and the CPI
was already measured in previous sections, the measurement of the SMRD is
incremental and built upon those indices with the inclusion of Peace & Security as
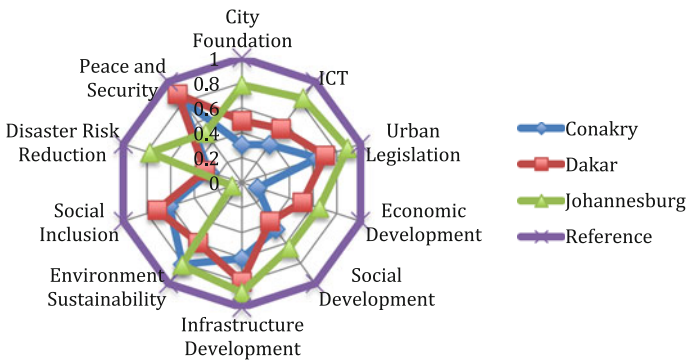well as Disaster Risk Reduction and Resilience (Fig. 4.20).

Fig. 4.20 Components of the SMRD. *Source* Provisional results from Mboup G (ed.) (2018)
Forthcoming publication "Smart economy in smart African cities", Springer

In addition to the urban challenges analysed in previous sections, the population of Conakry Peninsula has been constantly exposed to disasters, particularly to flooding during raining seasons. Apart from habitat degradation, floods have caused considerable economic, social and environmental losses in Conakry. Most households in Conakry are built in unplanned settlements that lack most basic services, particularly in Matoto and Ratoma, leading to frequent flooding and several other social and economic negative externalities. Associated with this heavy rainfall, the particular topographical situation of the city of Conakry favours recurring floods during the raining season.[1] In the Conakry Vision 2040, to reduce flooding occurrence, strategies include: a) Protect and restore natural outlets; b) Initiate studies on flood zones; c) Deepen studies on rainy reference events; d) Put in place compensatory measures for the relocation of the affected populations; e) Initiate a reflection on new channel models; f) Continue rehabilitation of valleys and flood zones and; g) Continue to improve the drainage network. In addition to disaster exposure, Guinea was classified among the less peaceful countries based on the Global Peace Index (GPI) ranking in 2015. The GPI scores are the aggregates of 23 qualitative and quantitative indicators across three thematic domains: the level of Societal Safety and Security; the extent of Ongoing Domestic and International Conflict; and the degree of Militarisation. Out of 163 countries, Conakry was ranked 117 with a score of 2.214 compared to the lowest score, which is estimated at 1.148 for Iceland and the highest score, which is estimated at 3.645 for Syria. For South Africa, the GPI score is estimated at 2.376, ranked at 136 behind Guinea. In Africa, only four countries—Senegal, Mauritius, Botswana and Namibia—are among the top 50 peaceful countries globally.[2] With a weak City Foundation, a low Human Development Index and a weak City Prosperity Index, it is obvious that high exposure to disaster coupled with high insecurity will make it worse with a very low level of Smart Metropolitan Regional Development Index. Though this a preliminary assessment of the SMRDI since data are not able for some sub-indices, rapid assessment of available data point to the fact Conakry SMRDI is very low due do to historic structural failure on urban development, chronic inequality of opportunities, widespread poverty, inadequate capital investment in public goods, etc.

4.7 Spatial and Economic Design Strategies for a Smart Conakry Metropolitan Regional Development

4.7.1 Background, Justification, Objectives and Strategies

Considering that the population of Grand Conakry will double by 2040 to reach 5–6 million inhabitants, the Government of Republic of Guinea commissioned a

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[1]Republique of Guinea, European Union and Louis Berger, 2016. Grand Conakry Vision 2040. The Original document Grand Conakry Vision 2040 is in French and remains the official document.
[2]https://reliefweb.int/sites/reliefweb.int/files/resources/Global%20Peace%20Index%20Results%20Map_0.pdf. Downloaded 8 March 2018.

study for the "Grand Conakry Vision 2040". The study proposes various scenarios of territorial settlements. These scenarios are aimed at preventing disasters that can hamper ecological, social, economic and urban development. Based on a structured dialogue within a Technical Committee and a Steering Committee with the Representatives of various ministerial departments, a consensus was reached on "a synthesis, balanced and controlled scenario" which is structured around three levels of intervention: (1) at the metropolitan level to develop and strengthen urban polarities; (2) at the agglomeration level to channel and structure urban extensions and; (3) at the peninsula level to renew the city (urban renewal). Recognizing that the Master Plan of the city of Conakry has become obsolete to tackle the challenges the city is facing, the government has commissioned a study for the "Grand Conakry vision 2040", which is the first step towards developing a new generation of master plans: the master plan of the great Conakry and the national land use planning scheme (SNAT).

The main objective of the Grand Conakry Vision 2040 is to "improve the living conditions of the residents of Conakry and adapt land-use planning and planning policies to the rapid urbanization of the metropolitan region" [5]. The "Grand Conakry—Vision 2040" is conceived as the preliminary framework for the elaboration of a future Master Territorial and Urban Planning. Its objective is to define the main key points and themes to be considered in order to make Conakry a modern liveable metropolis safeguarding the environment. The study aims to be the reference framework for several ministerial departments, communities and local authorities to set a long-term urban development target by 2040 (Figs. 4.21 and 4.22) [6].

This section is a prospective analysis of different ways economic and spatial transformations from these different programmes, reforms and plans will contribute to the smartness of the Conakry Metropolitan Regional Development. Most national and urban policies and programmes aim to spatially and economically transform the Conakry Metropolitan Region to be smart, sustainable, inclusive, resilient and prosperous. We will analyse the economic transformation expected in these programmes, reforms and plans. We will then proceed with a holistic analysis using the conceptual framework presented in the introduction in consideration of all dimensions of the smart metropolitan regional development such as: smart metropolitan regional foundation, ICT, smart Institutions and laws, smart economic development, smart infrastructure development, smart environment, smart social development, smart peace and security and smart disaster prevention and resilience.

The preferred scenario for the Grand Conakry Vision 2040 is an equilibrium scenario that pursues a strong ambition: the preservation of resources and the limitation of environmental damage through a polarized, oriented, controlled and optimized urbanization. This scenario is built on a triple strategy:

- The reinforcement of urban polarities relay to limit the demographic pressure on the peninsula
- The control and the structuring of the urban extensions to avoid a continuous development of the urbanization
- The intensification of the urbanized spaces of the peninsula

Fig. 4.21 Future National Master Plan. *Source* Republic of Guinea, European Union and Louis Berger, 2016. Grand Conakry vision 2040

Spatial Design and Planning Strategies will be at three levels: (1) Metropolitan region with the development and the reinforcement of urban poles connected to Conakry; (2) Urban agglomeration in increasing the urban extent of Conakry with the urbanization of neighbouring areas; and (3) City level with the densification of the city of Conakry (Fig. 4.23).

From the three scenarios, a resulting scenario is built with seven ambitious goals for a sustainable Conakry for all: (1) Strengthening territorial balances to create a network of solidarity-based cities in a preserved environment; (2) Controlling the city limits to prevent urban sprawl and preserve urbanization; (3) Optimizing the port system to decongest the city and protect the populations;
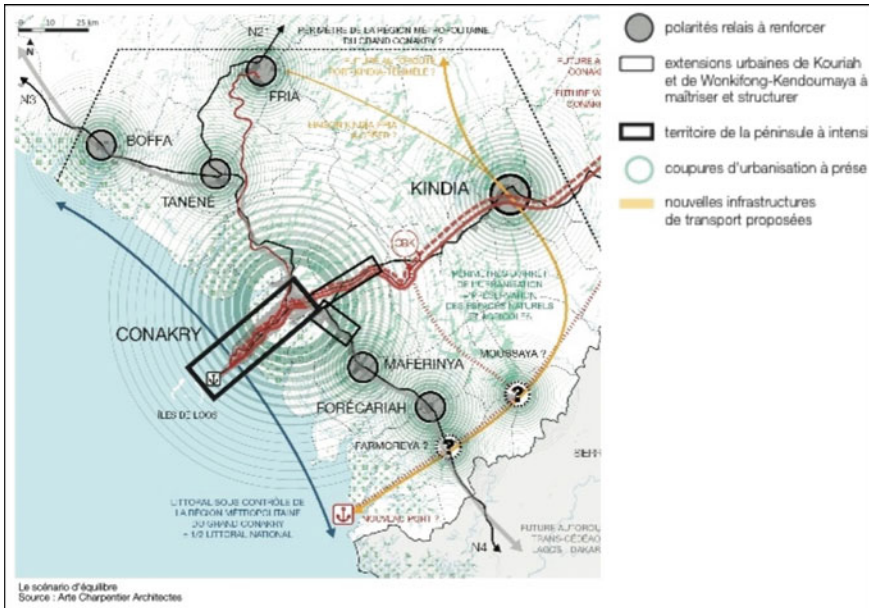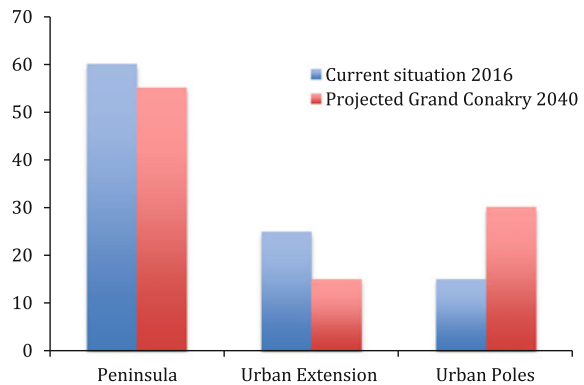
Fig. 4.22 A balanced scenario—Polarized and controlled urbanization to preserve the environment. *Source* Republic of Guinea, European Union and Louis Berger, 2016. Grand Conakry Vision 2040

Fig. 4.23 Spatial distribution of Conakry and surroundings. *Source* Figure prepared using data from Conakry vision 2040

(4) Restructuring the centrality to rebuild an efficient urban system on the peninsula; (5) Restoring the landscapes to build a healthier, safer and more enjoyable city; (6) Making the city sustainable to provide housing for everyone in mixed and lively neighbourhoods and; (7) Thinking waste as a resource to protect people, the environment and generate wealth.

(1) Strengthening territorial balances will consist of: (a) Strengthening and orga-nizing urban polarities in a modernized, hierarchical network connected to the regional network and; (b) Preserving fragile natural areas and agricultural economic zones, natural Park and protecting the islands and; (c) Develop the agro-industrial sector.

(2) Controlling the city limits will consist of: (a) Setting up new geographical boundaries according to the administrative, demographic and economic weight of the capital city; (b) Reviewing the administrative planning of the Grand Conakry and adapt the institutional and regulatory framework and; (c) Optimizing land use.

(3) Optimizing the port system will consist of: (a) Valuing the harbour tool in harmony with urban development (transfer of polluting and hazardous activi-ties) and the creation of a dry port and; (b) Modernizing and streamlining existing facilities.

(4) Restructuring the centrality will consist of: (a) Reorganizing the urban fabric; (b) Redeploying the centralities along the peninsula and the metropolitan area around the structuring facilities; (c) De-locating tertiary activities from the tip of the peninsula (Kaloum) to appropriate and developed sites; (d) Implementing a genuine mobility strategy; (e) Restructuring the urban network; (f) Developing a Urban Travel Plan (UDP) at the metropolitan area scale; (g) Developing capacities systems (a network of heavy axes in its own right to alleviate traffic) and diversification of the transport supply by facilitating inter-modality by means of adapted structures and; (h) Creating an authority for the management and regulation of urban transport.

(5) Making the city sustainable will consist of: (a) Ensuring a balanced distribution of settlements, structuring proximity facilities as well as urban services in a network that promotes accessibility; (b) Initiating the opening up of equipment, and controlling densification of the peripheral sectors; (c) Proceeding with the creation of a public operator responsible for producing and managing the social housing stock; (d) Implementing an ambitious land tenure policy, financing mechanisms, operational procedures and legal arrangements, in order to allow the community to operate on urban development in the name of the general interest and to better frame the creation of public or mixed operators and; (e) Establishing mechanisms for regular participatory communication and dialogue with populations.

(6) Restoring urban landscapes will consist of: (a) Restoring water quality and natural flows of the peninsula; (b) Renovating public spaces for the comfort and living environment of the inhabitants; (c) Protecting and managing the coastline to guarantee the integrity of the maritime public land (DPM) by a "littoral law"; (d) Establishing safeguard perimeters to protect sensitive areas and create the Mangrove Natural Park, and protecting the islands from urban pressure; (e) Modernizing the agricultural sector and develop the potential of arable land and wetlands, including in urban areas.

(7) Restoring urban landscapes will consist of: (a) Establishing a coherent strategy and reorganize the sanitation network master plan; (b) Creating networks for the collection, sorting, treatment and recovery of urban waste and; (c) Enhancing communication and training.

4.7.2 Conakry Metropolitan Region: Developing and Reinforcing Urban Polarities

Spatially connected and economically inter-dependant

The extended territory of Grand Conakry is characterized by an exceptional and fragile natural environment, punctuated by small and medium-sized towns, distributed within a radius of 150 km around the capital. To limit the influx of more and more people in the direction of the peninsula (and more generally in the direction of the littoral territories) and to prevent major and potentially irreversible environmental degradation, it is essential to channel some of this demographic growth towards these secondary cities through the reinforcement of their attractiveness, in a logic of complementarity and balance with the capital city. In sum, the strategies will consist to develop and strengthen urban polarities by: (1) Fixing and attracting populations in urban polarities; (2) Building a strong metropolitan region based on territorial solidarity and; (3) Preserving the natural and agricultural environment to enhance the productive force of the territory.

Existing urban poles to be part of the Grand Conakry Metropolitan Regions are

(a) Kindia (140 km from PK36) that has some potential in terms of tourism development but also, and above all, a strong potential for agricultural and agro-industrial development. The realization of new transport infrastructures such as the future highway Conakry-Mamou and the future railway Conakry-Kankan will reinforce this potential;

(b) Fria (120 km from PK36), the old mining industrial city: the announced revival of its aluminium factory closed since 2012, combined with strategies for diversifying economic activity, could mark the rebirth of the city and stimulate a new development facilitated by the upgrading of existing transport infrastructure (railway Conakry-Fria, Nationale 21 and even Katourou airport);

(c) Tanéné (65 km from PK36): the city of Tanéné is a crossroads city located at the junction of the National 3 (Conakry-Boké-Guinea Bissau) and Nationale 21 (Tanéné-Fria); This particular cross-city situation and the dynamism it generates could serve as a basis for economic development in relation to the flow of goods and encourage the development of agricultural activities;

(d) Boffa (120 km from PK36): the town of Boffa has a diversified economy (fishing, agriculture, solar salt, tourism, mining, etc.), which continues to be dynamic and which could thus contribute to fixing some of the expected demographic growth as a result of these many employment sectors;

(e) Maférinya (40 km from PK36): the town of Maférinya has developed agricultural production and in particular its pineapple production. This rich natural environment and its proximity to the capital, could allow it to develop productions dedicated to both domestic consumption and exportation with the planned airport;

(f) Forécariah (65 km from PK36): the town of Forécariah also develop many agricultural activities, some of which are dedicated to export (banana, pineapple, mango, oil palm, etc.).

Creation of urban poles

Respectively located 80 and 100 km from PK36 by road, the towns of Farmoreya and Moussaya are today only small villages. In the hypothesis of the construction of this new port, they could be developed in connection with the planned new railway infrastructure (the line connecting the port to the Simandou mine eventually supplemented by an additional line connected to the mine of the CBK), with a view to economic development linked to the flows generated, particularly around mineral processing industries.

It is important to note the spatial design of the metropolitan is aligned with the needs for transport, most of the urban pole to strengthen or to develop are related through the road network PK36. A large metropolitan region provides opportunities for economies of scale and agglomeration, but it will also call for large investments in infrastructures to respond to the increased demand for water, sanitation, solid management, energy and mobility. It will particularly come with increased demand on mobility that must be satisfied with an efficient public transit and connection between urban centres, accompanied with increased spaces for pedestrians and cyclists in order to safeguard the environment while creating economic growth. Economies of scale and agglomeration are, indeed, greater in metropolitan areas where transportation infrastructures are able to respond mobility needs with higher access to markets and resources than those where people mobility is impeded by deficient transportation infrastructures. Efficient urban mobility systems increase accessibility to markets, employment and investments and therefore provide better access of people to economic and social opportunities. Deficient transport systems create negative externalities and are source of social inequalities in cities. Efficient mobility systems make transportation means accessible and affordable to all people, while deficient mobility systems exclude the urban poor from many urban advantages and opportunities. The mobility of people and freight reflects the level of accessibility of urban residents to the multiple economic opportunities that cities offer.

Another important aspect noted is that the spatial design of the metropolitan region is aligned with specialization: Kindia has a strong potential for agricultural and agro-industrial development as well as for tourism development; Fria is an old mining industrial city (including aluminium); Tanéné, as a crossroads city, will ease the circulation of good in the metropolitan region and beyond; Boffa has a diversified economy (fishing, agriculture, solar salt, tourism, mining, etc.); Maférinya has developed agricultural production (particularly in pineapple); and Forécariah has various agricultural activities (banana, pineapple, mango, oil palm, etc.), particularly for export. However, this specialization calls for efficient transport infrastructures that must be assessed, planned and implemented. Efficient mobility allows localities of urban agglomerations to specialize in the production of goods and services for which they have comparative advantages and ease inter-localities cooperation. This will also allow large-scale production of goods and services that can be distributed within the metropolitan regions and beyond with time, cost and reliability opportunities [1]. This is the way the economies of scale and agglomeration associated to large urban agglomerations and high densities can be materialized.

An important forgotten component in the transport sector in Conakry as in most African cities is the movement of freights. Today urban logistics, as a strategy ensuring efficient freight movements and innovative responses to urban customer and business demands, is an emerging field of investigation making the movement of freight efficient while mitigating congestion and environmental externalities [66]. The development of the Grand Conakry, the Conakry metropolitan region with specialized urban poles will, indeed, result in growing quantities of freight moving between cities. There will be an impressive variety of supply chains servicing a wide array of economic activities such as agro-industrial from Kindia, agriculture products from Forécariah, industrial products from Fria, etc. As freight traffic commonly shares infrastructures with the circulation of passengers, the mobility of freight in between and within urban areas will be problematic along the development of the metropolitan region. It has been noted that congestion associated to transportation of freight starts to be a serious issue once a threshold of about one million inhabitants is reached. Considering the growing level of production, distribution and consumption of goods, the metropolitan region should have planning and circulation management schemes where urban freight distribution is preeminent [66]. Though transport infrastructures are factored in the development of the metropolitan region, it must be further underscored.

4.7.3   Extension of the Conakry Urban Agglomeration

Extension of the Conakry Urban Agglomeration to channel and structure urban extensions will consist of: (1) Preventing the process of urban sprawl in order to preserve the natural environment through the establishment of perimeters for urban land use; (2) Structuring, reorganizing and controlling the urban extensions.

In order to protect the natural environment and preserve urbanization for territorial ecological balances, it is urgent to stop the rampant urbanization and to engage in strategies for structuring territories that have already been impacted. It must define precise and stabilized limits and engage the optimization of the use of land by connecting together these "pockets of urbanization" disconnected from each other, and planning in these new urban spaces to accommodate a significant portion of the population expected by 2040.

It is along the National 4, which is much affected by the unplanned urbanization, to limit the urban development to the limit of the present sub-prefecture of Coyah and thus impose a limit of urbanization between the commune of Kendoumaya and that of Maferenya (which, along with that of Friguiagbé near Kindia, is one of the main pineapple producing areas in the region and of its surrounding agricultural areas must be protected) as well as protection limits of the northeastern reliefs and mangrove protection on the southeast side.

Beyond this limit, it is a question of favouring multi-polarity (rather than continuous linear extension) and a controlled development of the existing polarities (Maférinya and Forécariah) or in the future, guaranteeing the preservation of the natural and agricultural environment in which they operate and from which they derive their wealth and potential.

Along National 1, around Kouriah, it is again to limit the urban development on the edge of the current sub-prefecture of Coyah and to impose an urbanization limit before Kolibaya, in limit of the plateau rocky, which limits the valley. Transversally, it is a question of setting limits adapted to the preservation of the slopes of the reliefs and the agricultural zones.

In these peri-urban areas, there are many different spaces (natural spaces, agricultural spaces, built-up areas, contemporary habitats and traditional habitats) and many uses that are as much linked to the urban context as to the rural context: this spatial mix land use must be preserved and serve as a basis for structuring the territory biodiversity. This will particularly include:

- Reintegrate hierarchical centralities for the programming of equipment and services to the population
- Structure a hierarchical road service to the heart of neighbourhoods;
- Structure a network of public spaces and green spaces articulated with the spaces of nature which can still be preserved on the still free spaces of any urbanization
- Develop pilot operations of habitat and typological classification;
- Ensure the management of rainwater through the preservation of valleys; and
- Implement pilot projects such as Farms of Guinea and the "Filter counter" for the management of solid and liquid waste.

These areas of fringes could in particular enable the implementation of particular strategies for managing the city/nature interface through pilot operations of peri-urban agriculture, agro-forestry, development of gardening in the lowlands, maintaining traditional agriculture practices, etc.

- At the peninsula level, to renew the city will consist of: (1) Building an efficient, safe, healthy and pleasant capital and; Optimizing the use of the soil by densification of its structure to accommodate new urban areas with improved living conditions.

4.7.4 (Re) Build the City on the City: A Dense, Restructured, Efficient, Safe, Healthy and Liveable City

The protection of the environment, and in particular the natural and agricultural areas of the greater territory of the metropolis, today requires a strong ambition capable of controlling urban sprawl while allowing the reception of new populations on territories already urbanized. This need for a more rational use of land must take place through the (re-) construction of the city on itself, necessarily integrating a infill effort, and must be understood as the opportunity to improve the living conditions of today's Conakry residents by overcoming the dysfunctions of the constituted urban space.

Thus, through this effort of densification and intensification of already urbanized spaces, the aim is to implement a more efficient use of resources in the broad sense: land resources, energy resources, water resources, resources in materials, etc. The compact city, the dense city, is the one that allows efficient use of resources through better management of networks and opportunities for pooling and implementation of short circuits for recovery, reuse, recycling, etc.

Combined with the implementation of a larger functional diversity makes it possible in particular to act on a functional mix, in particular the mobility needs over distances of displacement, and modal shares, and consequently on energy consumption and gas emissions energy consumption and greenhouse gas emissions. But, it's not just about acting quantitatively on the urbanized area of the peninsula to maximize on the peninsula's urbanized space to maximize its use by aiming at the "technical performance" the urban system, but to engage in actions of the urban system, but to urban renewal coherent with the urban renewal set consistent with all the urban strategies to be implemented at scale territorial guarantee of territorial improvement, the only guarantee of an improvement in the quality of life as a whole and sustainable urban development (see § NOTES OF FRAMING).

Therefore, these urban renewal actions must not simply consist of an increase of the volume built on the surface considered but they must be oriented towards the implementation of a densification "qualified", inscribed within a global strategy of improvement. It is an uncompromising development to establish and/or restore urban development, capable of establishing and/or restoring a number of balances that have now been broken.

This (re-) construction of the city on the city must thus contribute to:

- The redeployment and rebalancing of central and urban functions at the metropolitan level—the integration of greater diversity Functional on all scales of the urban up to all the scales of the urban, to the heart of neighbourhoods;

- The mobility network, the restoration of continuity between neighbourhoods and their connection to continuity between neighbourhoods and their connection to the metropolitan structure;
- Support for housing policies and in particular the elimination of precarious housing;
- Upgrading neighbourhoods access to basic urban services (access roads to basic urban services (highways servicing, water, electricity, sanitation, and public waste facilities, ICTs, etc.) and public facilities nearby (school equipment, health, etc.);
- The preservation and reintroduction of spaces nature in the city (nature of nature ornamentation nature in the city (nature of ornament, ecological nature, productive nature, etc.)—the restoration of public spaces—etc.

This third scale of the recommended development strategy is resolutely a long-term task, necessarily transversal (the question of urban renewal deals with all the problems: urban, social, economic, cultural, environmental issues, etc.) and inscribed in a global vision. In this perspective, the role of the National Agency for Urban Renovation (ANRU) will be determining and will require adapted means.

4.7.5 Sectorial Programmes for the Metropolitan Region, the Urban Agglomeration and the Peninsula

The spatial design of the metropolitan region, the urban agglomeration as well as the re-structuration of the Peninsula will be supported by various sectorial programmes such as on: Housing, Land, Transport and Mobility, Port and Port Infrastructure (Fig. 4.24).

At the Housing sector, strategies include: development of a city and housing policy; creation of a public social housing agency; supplement and strengthen other instruments of the implementation of the housing policy; promote the use of local building materials; re-structure urban governance and; put in place sustainable financing mechanisms.

Fig. 4.24 Necessary conditions of the urban re-structuration. *Source* Republic of Guinea, European Union and Louis Berger, 2016. Grand Conakry Vision 2040

At the Land sector, strategies include: (a) Clarify the scope and conditions of application of customary law alongside modern law; (b) Complete, consolidate and modernize the cadastral system; (c) Assess the state's land assets; (d) Reclaiming the state's land assets; (e) Develop land planning documents; and (f) Engage a policy of "production" of land.

At the Transport and Mobility sector, strategies include: (a) Establishment of traffic restriction; (b) Development of a fleet of taxi boats; (c) Structuring a road network at the scale of the Greater Conakry metropolitan area; (d) Create a bus station at PK36; (e) Reinforcing the railway; (f) Organize maritime connections; (g) Develop a BRT system on its own site and improve the existing urban network; (h) Make accessible the districts of the peninsula; (i) Implement strategies for stationing; (h) Gather typologies of structures and modes of maintenance of the road network.

At Port Infrastructure sector, strategies include: (a) Engage and optimize the port extension project; and (b) Improve conditions for pre- and post-shipment of goods.

At the Urban Space level—including Public Spaces, coastal areas (link between the sea and the city), urban nature spaces (such as the lowlands, urban forests and woodlands as well as urban and peri-urban areas of agriculture), and in general green spaces. The strategies include: (a) Reintroducing the question of public space in the structuring of the metropolis and neighbourhoods; (b) Initiate a coastal reclamation project; (c) Strengthen the notion of green city; (d) Preserve and develop alignment trees; (e) Protect classified urban forests and develop urban woodlands.

At the Environment Sector, the strategies include: (a) Set up urbanization perimeters; (b) Preserving and restoring mangroves; (c) Continue to support the development of solar "culture"; (d) Modify practices related to mangrove rice cultivation; (e) Implement accompanying measures and protection against climate change; (f) Promote reforestation actions; and (g) Create a large National Nature Park on the mangrove territories.

At the Agriculture Sector, strategies include: (a) Promote the agricultural potential of relay polarities; (b) Rethinking the agricultural organization; c) Better channel the development of palm groves; (d) Promote endogenous positive and sustainable knowledge and practices; and (e) Promote urban and peri-urban agriculture.

Sanitation—solid waste (An ecological, social and economic emergency), strategies include: (a) Start a characterization campaign; (b) Restart the collection service; (c) Set up one (or more) new landfill centre (s); (d) rehabilitate the site of the "Mining area"; (e) Develop and promote local waste recovery methods; (f) Promote a centralized treatment of biomedical waste; (g) Optimize the collection service "Filter Counter"; (h) Develop waste management units oriented towards the circular economy;

Sanitation—wastewater, strategies include: (a) Rehabilitate and optimize the Petit Bateau boat station; (b) Manage and valorise waste materials through pilot projects of multifunctional platforms; (c) Establish the sanitation scheme of the individual network of the city; and (d) Extend the collective network.

Sanitation—rainwater, strategies include: (a) Protect and restore natural outlets; (b) Initiate studies on flood zones; (c) Deepen studies on rainy reference events; (d) Put in place compensatory measures for the relocation of the affected populations; (e) Initiate a reflection on new channel models; (f) Continue rehabilitation of valleys and flood zones; (g) Continue to improve the drainage network.

Institutional Setting for the creation of a metropolitan region, strategies include:

(a) **Create a solid legal base favouring inter-communality**: Promulgate and implement the law on the code of local authorities; immediately transfer the 32 competencies listed in Article 29 of the Local Government Code to local authorities, as well as the financial means involved; clearly define the status and competences of the urban and rural communes mentioned in articles 18 and 19 of the Code of Local Authorities; and develop a public policy of the city.

(b) **Create the EPCI of the urban community of Grand Conakry**
An EPIC is an administrative structure governed by the provisions of the Code of Local Authorities, which includes municipalities that have chosen to develop several common skills, such as spatial planning, public transport or the management of public buildings. The Grand Conakry Vision 2040, to be viable, must be based on a solid juridical framework, privileging the inter-communality, as: —policies aiming to unite the territories, to pool skills, fiscal resources, projects in a more integrated way—a real legal tool in the service of municipalities. A clear definition of inter-communality must therefore be inserted in the Community Code, recalling that this is for urban or rural communes to constitute a Public Institution of Inter-communal Co-operation (EPCI). The EPCI receives by its statutes competences that it exercises in place of the communes. It is therefore essential that the state transfer the 32 competencies to the communes so that they can transfer them to the EPIC, if necessary, etc.

(c) **Create the Metropolitan Pole of Grand Conakry**
Once launched, the Grand Conakry could favour the Metropolitan Pole, connecting the Metropolis (very integrated inter-municipal structure) and the network of cities. The Metropolitan Pole is a flexible tool with a few legislative specificities: —a minimum population is required—its territory is in one piece and without enclave. Its actions of metropolitan interests are: —economic development—development transport infrastructure and services—the promotion of innovation, research, higher education and culture.

Centrality and Programming

The creation of an efficient and sustainable metropolis imposes a deep restructuring of the urban system through the redeployment of balanced centralities spread over the entire territory of the peninsula and associated with the implementation of greater functional diversity at all scales. The implementation of an efficient urban system, and through it an efficient transport system requires a profound transformation of the existing urban structure and in particular a redeployment of the centrality at the scale of the new limits of the urban area (Framework: Transport and

Mobility). A first step in this necessary rebalancing of urban functions is being completed through the announced realization of the new Koloma administrative centre, which is expected to accommodate a portion of the administrations and ministries now located in Kaloum. However, if this first step marks a necessary prerequisite for the construction of a more efficient metropolitan structure, to create a balanced and efficient urban system, it is imperative to structure other points of attractiveness on the linear peninsula. In particular, the new territorial scale of the metropolis, considered not within the limits of the peninsula but in a wider area, extended to Dubréka, Coyah, Kouriah, Wonkifong and Kendou-maya, but also to relay polarities within a defined centre of gravity.

Use commercial functions and markets to structure the city and its neighbourhoods

Trade is a formidable driver of economic activity and urban animation. Markets in particular are one of the most polarizing elements of urban life. They are the central point of complex networks of supply, storage, distribution: a sum of functions which generates a large number of activities but which constitutes today a major obstacle to the fluidity of the traffic and transport, which regularly leads to network congestion. The district of Madina is the perfect illustration: the concentration of commercial activities generates daily significant traffic jams on the highway. Because the commercial function invades everywhere the urban space, beyond the limits of the markets, on the axes of transport and the intersections. This dynamism of the commercial function must be used to accompany, control, guide and channel new urban developments and the renewal of the city on itself. The structuring of the commercial offer must thus be hierarchical at different scales of the metropolis and be articulated to the structuring of the mobility. These different market centres will have to be associated with exchange hubs integrated with urban transport and the public transport network, to organize intra-city and intra-neighbourhood flows.

Consideration of the concept of centrality at all scales of urban space

In addition to the commercial function, all urban functions must be broken down at different scales of the city: metropolitan scale, municipal scale and neighbourhood scale, but also at the sector level. At these smaller scales, there are "neighbourhood" centralities that could be built around a public area nearby: primary school, mosque, small shops, neighbourhood house dedicated to associations, etc. (Fig. 4.25).

ICT can ease this process with innovative e-planning along with design, management and monitoring. From the beginning of the 21st century a digital citizenship, particularly the "Millennial" generation, has started to emerge in Conakry as in many African cities [67]. Maximizing the digital dividends requires better integration of ICTs with the other factors of smart cities such as: city foundation, infrastructure development, environment sustainability, social development, disaster prevention, resilience, peace and security. ICT can be seen as substitution and catalyst factors, but the other factors (or the analogue part) of the operation are crucial in making smart economy. ICT alone will produce little in the smart
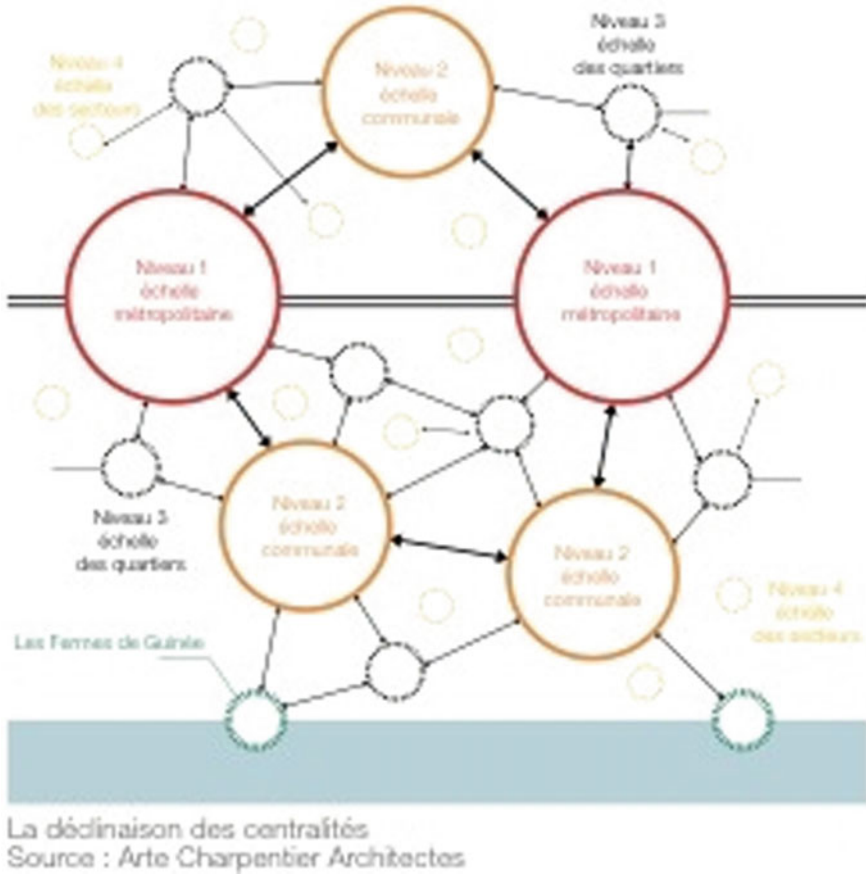
La déclinaison des centralités
Source : Arte Charpentier Architectes

Fig. 4.25 Centralities diagram

metropolitan regional development. 'Smart' is not an end in itself [68]. It is the way ICT is integrated in the city development that will determine the city smartness.

ICT can in particular impact the transport sector in many ways among them we can enumerate two which will be the focus of this paper: (a) the digitalization of the transport sector as it happens in all sectors and; (b) substitution (partial or full) of mobility to perform or access services [69]. The ICT revolution with the rapid development and use of Internet, digital mobile communication, and "big data" analysis enable to create a less costly and more powerful "intelligent transport systems" (ITS) [70]. The ITS have a greater potential to more efficiently manage transportation assets, improve road safety, reduce traffic congestion and travel time. This will boost productivity and reduce greenhouse gas (GHG) emissions [71] (Fig. 4.26).

Conclusion

Considering its geographical location as a peninsula in the Atlantic Ocean, Conakry has the potential to be an agro-industrial, green city in addition to its huge potential of fish production. Wetlands areas are sources of income from agriculture, livestock, and crafts, among other activities. They play an important role in maintaining the water quality and the prevention of natural hazards. These are also ideal places for reception and reproduction of waterfowl which are indispensable elements for the ecological balance of aquatic environments and key links in the food chain, hence the importance of the preservation of wetlands. If well planned and designed, Conakry can be a smart metropolitan region where citizens enjoy high quality of life. In addition to its geographical advantages, the Conakry Peninsula has a population of nearly of 2 million that, as large urban agglomerations, constitutes economic and social opportunities as well as challenges depending on how the urban growth is planned and managed. However, Conakry as most African cities has not been able so far to respond to growth in accessibility demand and several other needs such as access to water, sanitation, management of solid waste, and streets and other public spaces, key elements of a city foundation.

Considering the proliferation of informal settlements along the rapid urbanization of the Conakry Peninsula and surroundings, the Government of the Republic of Guinea is developing a holistic approach, the "Grand Conakry Vision 2040", for a smart metropolitan regional development through economic as well as spatial design strategies. The Grand Conakry Vision 2040 considers three spatial design strategies: (1) at the metropolitan level to develop and strengthen urban polarities; (2) at the agglomeration level to channel and structure urban extensions and; (3) at the peninsula level to develop urban renewal approaches. The main objective of the Grand Conakry Vision 2040 is, indeed, to "improve the living conditions of the

residents of Conakry and adapt land-use planning and policies to the rapid urbanization of the metropolitan region". This is built on seven ambitious goals for a sustainable Conakry for all: (1)Strengthening territorial balances to create a network of solidarity-based cities in a preserved environment; (2) Controlling the city limits to prevent urban sprawl and preserve urbanization; (3) Optimizing the port system to decongest the city and protect the populations; (4) Restructuring the centrality to rebuild an efficient urban system on the peninsula; (5) Restoring the landscapes to build a healthier, safer and more enjoyable city; (6) Making the city sustainable to provide housing for everyone in mixed and lively neighbourhoods; and (7) Thinking waste as a resource to protect people, the environment and generate wealth.

An important aspect noted in the Grand Conakry Vision 2040 is that the spatial design of the metropolitan region is aligned with specialization: (1) Kindia has a strong potential for agricultural and agro-industrial development as well as for tourism development; Fria is an old mining industrial city (including aluminium); Tanéné, as a crossroads city, will ease the circulation of good in the metropolitan region and beyond; Boffa has a diversified economy (fishing, agriculture, solar salt, tourism, mining, etc.); Maférinya has developed agricultural production (particularly in pineapple); and Forécariah has various agricultural activities (banana, pineapple, mango, oil palm, etc.), particularly for export.

However, this specialization calls for efficient transport infrastructures that must be assessed, planned and implemented. Efficient mobility allows localities of urban agglomerations to specialize in the production of goods and services for which they have comparative advantages and ease inter-localities cooperation. This will also allow large-scale production of goods and services that can be distributed within the metropolitan region and beyond with time, cost and reliability opportunities. The spatial design of the Grand Conakry Vision 2040 is, indeed, aligned with the needs for transport with most of the urban centres of the metropolitan region connected to the main road of the city (PK36). In addition to that, transport strategies for the Grand Conakry Vision 2040 include: (a) Establishment of traffic restriction; (b) Structuring a road network at the scale of the Greater Conakry metropolitan area; (c) Reinforcing the railway; (d) Organize maritime connections; (e) Develop a BRT system on its own site and improve the existing urban network; (f) Implement strategies for stationing; and (g) Gather typologies of structures and modes of maintenance of the road network.

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