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Progress in the implementation of the regional integration and trade programme: (e) inclusive infrastructure development: the key to promoting Africa's industrialization

Promotion of Africa's industrialization through inclusive infrastructure development

I. Introduction

1. A structural transformation of African economies that yields inclusive growth and decent jobs critically depends on industrial development.¹ The centrality of development throughout the world is the ability to create more equitable, sustainable livelihoods for all people. Inclusive and well-diversified economies, with strong backward and forward linkages, can assist African resource-rich countries in achieving better economic performance, while reducing their exposure to external shocks, especially the vagaries of international commodities markets.

2. The present report discusses Africa's structural transformation through inclusive and sustainable industrialization and the important role of infrastructure in this process. The analysis demonstrates a direct link between the levels, types and patterns of industrialization and the present economic infrastructure, in particular transport (road, rail, water and air), power and information and communications technology (ICT). The consensus is that quality economic infrastructure² in Africa is critical for industrial development, as exemplified by current efforts that focus on interconnecting Africa through increasing quality infrastructure on the continent.

3. The industrial output contribution of infrastructure facilities includes both direct and indirect channels. The former relates to infrastructure services (e.g., roads combined with vehicle and energy for transportation) purchased by industries and infrastructure assets, such as energy and water that are used as

* E/ECA/CRCI/10/1

¹ See Economic Commission for Africa, *Economic Report on Africa 2013: Making the Most of Africa's commodities: Industrializing for Growth, Jobs and Economic Transformation* (Addis Ababa, 2013), *Economic Report on Africa 2014: Dynamic Industrial Policy in Africa—Innovative Institutions, Effective Processes and Flexible Mechanisms* (Addis Ababa, 2014), and *Economic Report on Africa 2015: Industrializing through Trade* (Addis Ababa, 2015).

² In the present report, quality infrastructure includes elements of economic efficiency, social inclusion, safety and resilience, environmental sustainability and the convenience and comfort, which are seen as vital to sustainable development.

inputs by the manufacturing sector. There are several levels of indirect channels. Well-functioning infrastructure contributes to increasing cost efficiency in the overall economy, while improving access to larger regional markets for productive resources and industrial output. Infrastructure could be a determinant of a country's attractiveness to foreign direct investment. It also yields good education and better health outcomes that serve the industrial sector (e.g., good access to electricity tends to improve educational attainment). Industrial development therefore requires specific infrastructures, which suggest that industrialization is also a catalyst for infrastructure development. For example, to operate fully and efficiently, a metallurgical complex in mining towns requires increased access to energy that would, in turn, result in building new energy infrastructure or an improved road, railway and port network to trade in a cost-efficient manner the industrial output of a country.

4. Competitiveness in the production of industrial goods (consumer, intermediate and capital and low-medium-high technology) depends on the availability of an efficient transportation network, cheap electricity and good ICT systems. In addition, relevant infrastructure stock is pivotal to Africa's "behind the border" agenda, that is, regional integration ambition (the Continental Free Trade Area). Well-functioning infrastructure is required for trade liberalization to achieve its objectives to contribute to improving efficiency of resource allocation and boosting manufacturing-led exports.³ Cross-border infrastructure and regional economic development can support the integration of landlocked economies by connecting them to regional and global markets.

5. Quality infrastructure matters for industrial development and competitive economies. In Africa, however, numerous infrastructure bottlenecks are serious impediments to the continent's industrialization. The transportation network, which is vital to move goods and people in a cost-efficient manner, face significant shortcomings. Road density in Africa is more than four times lower than the world average and the continent's freight cost is approximately four times more expensive, compared with developing countries in other parts of the world.⁴ The railways network throughout the continent, except perhaps for a few countries such as Morocco, South Africa and Tunisia, is outdated and consists mostly of single lines, penetrating inland from seaports with very limited interconnections. Electric power, a vital input for factories, is grossly inadequate. Low access to electricity is a serious issue in most of Africa, and nearly half of the population have no access to electricity.⁵ Digital connectivity, vital for technology advances and industrial innovation, is struggling to take off. In 2016, the value for the ICT Development Index, published by the International Telecommunication Union, is nearly 2.5 points for Africa, approximately half of that of the world. In the same year, only 7 African countries were among the top 100 countries in the world in terms of ICT development. Even the top performing country in Africa (Mauritius) ranked seventy-third in the world.⁶

6. Notwithstanding these challenges, Africa has also recorded some success in terms of industrial development. Between 1995 and 2015, the African manufacturing value added in absolute terms (constant 2010 dollars) more than doubled according to the United Nations Industrial Development Organization

³ César Calderon and Luis Servén, "The effects of infrastructure development on growth and income distribution", Working Paper No. 3400 (Washington, D.C., World Bank, 2004).

⁴ Albert Mafusire, and others, "Infrastructure deficit and opportunities in Africa", *African Development Bank Economic Brief*, vol. 1 (September 2010), pp. 1–15.

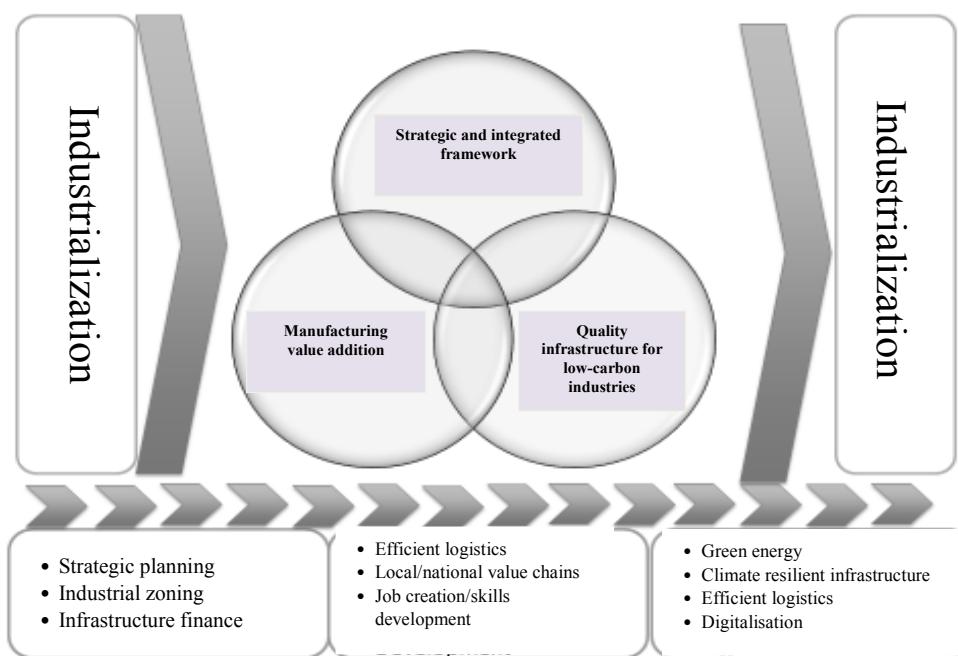
⁵ International Energy Agency, *Africa Energy Outlook - a Focus on Energy Prospects in Sub Saharan Africa* (Paris, 2014).

⁶ International Telecommunication Union, *Global ICT Development Index 2016* (2016). Available at www.itu.int/net4/ITU-D/idi/2016/.

(UNIDO). Some of the success stories of the African manufacturing sector range from dynamic textile and high-tech industries in Egypt, apparel and footwear products in Ethiopia, automobile manufacturing in South Africa and diamond value chain in Botswana to wood value-added products in Gabon and agro-food industries in Senegal and Kenya. In these various cases, the industrialization process has in part been led by upgraded and expanded infrastructure facilities and their related services.

7. This report provides a discussion on a selection of issues to take into consideration as the continent fosters its economic development path. These issues include an integrated framework for infrastructure promotion and industrial development, the impact of key infrastructure assets on the African industrial trajectory and the need for quality infrastructure to support low carbon industrial development in Africa (see figure I). It also offers a set of recommendations on how to tackle these issues to accelerate industrial development on the African continent. It draws from an ongoing research project undertaken by the Economic Commission for Africa (ECA) to show how infrastructure assets can serve as a catalyst to industrial development in Africa.

Figure I
Conceptual framework of infrastructure contribution to industrialization



II. Overview of infrastructure-industrialization issues

A. Integrated framework for planning, implementing and financing infrastructure

8. The success of industrialization in Africa depends in part on the continent's capacity to create a conducive environment that promotes quality infrastructure assets. The interconnection between, among other things, industrial activities, infrastructure development, trade and education calls for a high degree of coherence and coordination between the policies and strategic plans that drive country development. In most African countries, the starting point for policy frameworks is a medium-term or long-term national development strategy, which results in several other policies and strategies. These policies and strategies have placed industrial development as a key pillar

to prosperity and inclusive growth, while infrastructure development, among other things, is conceived as a key enabler to this process. The policy development process in many African countries is based on a participatory approach that promotes mutually reinforcing actions from various entities. This, in turn, contributes to creating synergies towards achieving the agreed objectives of development strategies.

9. Quality infrastructure is also realized through special policies to ensure that marginalized groups play a meaningful role in infrastructure development and investment. Some of these policies may be aimed at dealing with gender inequities in infrastructure planning and development. Other policies may be used to integrate young people into the mainstream economy through productive work. In the case of South Africa, in which the structure of economic participation is according to race, preferential policies ensure that black South Africans participate in public procurement, including infrastructure and industrial contracts, through a preferential policy. Kenya dedicates specific industrial zones almost exclusively for small businesses. The public procurement rules of the country, amended in 2013, allow 30 per cent of all types of contracts for young people, women and persons with disability without competition from established firms.

10. Beyond a policy framework, integrated solutions are also driving African countries' industrialization. Integrated economic zones, including special economic zones, industrial zones and export processing zones are viewed as a viable option to bypass persistent and significant infrastructure constraints in Africa. From Egypt, Gabon and Kenya to Ethiopia, Rwanda and South Africa, these zones are supporting the countries' local manufacturing sector. The economic zones also facilitate the transfer of knowledge and technology and, access to resources, including inputs and suppliers, and allow businesses to achieve greater productivity and efficiency, while creating millions of jobs.⁷ Nevertheless, success of ongoing industrial clustering strategies in Africa also depends on adequate infrastructure planning and financing and the existence of strong linkages of the clusters to national, regional and international markets.

11. Africa also needs an integrated and sound regulatory framework that attract investment in infrastructure projects. Even with the tremendous efforts made to scale up infrastructure assets throughout the continent, the investment gap remains wide. Africa would need \$93 billion annually to close its infrastructure gap.⁸ This suggests that levels of funding averaging \$87 billion for the period 2012–2015⁹ leave a significant gap. Policy reforms are crucial to increase infrastructure investment in Africa. Investment rules and regulation need to be clear and predictable. In addition, strong national leadership and strengthened partnerships between the public and the private sector under a public-private partnership arrangement are important. There is a need for regional collaboration in infrastructure development projects that opens up larger markets for industries. Countries should explore other financing sources, including Africa's diaspora and institutional investors such as insurance and pension funds.

⁷ African Development Bank, Organization for Economic Cooperation and Development and United Nations Development Programme, *African Economic Outlook 2017: Entrepreneurship and Industrialization* (Paris, OECD Publishing, 2017). Available at www.africaneconomicoutlook.org/en.

⁸ Cecilia M. Briceno-Garmendia and Vivien Foster, *Africa's infrastructure: a time for transformation* (Washington, D.C., World Bank, 2009). Available at <http://documents.worldbank.org/curated/en/246961468003355256/Africas-infrastructure-a-time-for-transformation>.

⁹ Infrastructure Consortium for Africa, *Infrastructure Financing Trends in Africa 2015* (Abidjan, 2015).

B. Infrastructure contribution to manufacturing value added in Africa

12. Irrespective of several challenges, Africa has recorded some successes in terms of industrialization. These range from textile and high-tech industries in Egypt, apparel and footwear products in Ethiopia, automobile manufacturing in South Africa, diamond value chain in Botswana to wood value added products in Gabon and agro-food industries in Kenya. These success stories have contributed to creating, directly and indirectly, millions of jobs. In these various cases, infrastructure assets including transportation networks, energy and ICT have led the industrialization process.

13. Transport infrastructure remain key for African manufacturers to procure inputs and trade their output cost-efficiently. A significant share of intermodal freight in Africa passes along roads. In Egypt, for example, roads account for more than 90 per cent of the country's internal freight.¹⁰ Seaports are essential parts of African trade and serve as intersection nodes in logistic chains between waterways, including sea and land transportation. The ports of Mombasa and Dar es Salaam are important gateways to eastern African countries. At present, more than 90 per cent of Africa's total trade passes through seaports.¹¹ Railway infrastructure, notwithstanding its overall frustrating state, contributes to economic performance in some parts of the continent. The South African rail infrastructure plays an important role for trade, connecting the country's ports with inland and regional markets located in Botswana, Mozambique, Namibia, Swaziland and Zimbabwe. In Gabon, the trans-Gabon railway plays a critical role in moving mining and wood processed products from production centres to export markets.

14. Several African countries are transforming locally or regionally their natural resources from agricultural products to minerals, thanks to the improvement in accessing energy. In the case of Egypt, industry is the second energy user after housing. In Gabon, the Moanda metallurgical complex, inaugurated in 2015, manufactures value-added manganese products, such as silico-manganese and manganese metal, by depending primarily on the energy supplied by the new Grand Poubara hydroelectric dam. In Botswana, the various nodes of the country's vertically integrated diamond value chain (from mining to jewellery manufacturing) are capital-intensive and thus rely heavily on a reliable energy supply. In a country such as Ethiopia, in which natural resources are limited, cheap access to electricity along with low labour cost have contributed to attracting foreign manufacturers.

15. Although there are few digitalized economies in Africa, there are cases in which a dynamic ICT sector has supported industrial development. In Kenya, ICT has revolutionized the way in which it conducts business. Technological inventions, such as mobile money transfer, have made business transactions much easier, especially for small and medium businesses and farmers in rural Kenya. In Egypt, a dynamic ICT sector has contributed to supporting domestic high-tech industry. The Kearney Global Services Location Index of 2016 ranked Egypt as a top-performing global ICT outsourcing destination, at sixteenth worldwide and the leader in Africa. In South Africa, the ICT sector ranked among the top sectors in the country in terms of its contribution to gross domestic product.

¹⁰ British Expertise International, *Egypt in transition: infrastructure and development* (Spring 2015).

Available at www.britishexpertise.org/bx/upload/Events/Egyptintransition_Spring2015_LR.pdf.

¹¹ Economic Commission for Africa, *Africa's Blue Economy: A Policy Handbook* (Addis Ababa, 2016).

C. Quality infrastructure for low-carbon industries

16. The important role of quality infrastructure in industrial development is undoubtedly. Critically, the type of infrastructure deployed determines the quality and pace of the industrialization trajectory. For example, deploying clean or “green” (renewable energy and energy efficiency) infrastructure contributes to the attainment of low-carbon and climate-resilient industrialization. In turn, a low carbon development pathway offers African countries a range of opportunities. These include avoiding “locking-in” carbon-intensive technologies into future development; “tapping” into global climate funds, which will provide much-needed finances for its development; and utilizing vast renewable energy potentials to improve energy access through low-cost and low-polluting technologies. It also includes diversifying energy mix and reducing the dependence on expensive fossil fuels and building one’s own technical capacity and joining the “new development” race as a competitive player.

17. Africa has abundant renewable and non-renewable energy resources that, if harnessed, can power its industry. Not only will this increase the energy generation capacity and access, but it can also lead to a low-carbon industrial development. Nevertheless, very few of these renewable energy resources have been adequately harnessed. For example, less than 10 per cent of Africa’s hydro is exploited for energy. The total geothermal energy potential is 14,000 megawatts in East Africa’s Rift Valley, but only a little of this has been successfully generated in Kenya (3,000 megawatts), Ethiopia (approximately 1,000 megawatts), Djibouti (approximately 850 megawatts), Uganda (450 megawatts) and the United Republic of Tanzania, which has 150 megawatts.¹² Egypt has a rate of sunlight coverage of between 9 and 11 hours per day and the best sites considered for wind energy is the Gulf Suez area because of its high and stable wind speeds. The contribution of wind and solar power, however, represent less than 5 per cent of the country’s energy generation.¹³ Notwithstanding its huge potential, biofuel energy production remains limited and small scale.

18. Biofuel energy could become an industry of its own if efforts of developing biodiesel from *jatropha* (a drought-resistant flowering plant) escalate in countries such as Côte d’Ivoire, the United Republic of Tanzania, Zambia and Zimbabwe. Efforts are currently under way at mass-scale solar production, especially connecting solar power to the grid in many African countries. Except for few countries (Morocco and South Africa, among others), however, the scale remains negligible by international standards. What is not mentioned is that renewable energy conversion technologies are capital-intensive and technology-intensive. Little investment is going to the renewable sector, as opposed to fossil-based energy, such as coal, oil and gas. Innovative financing for renewable energy technologies has to be deployed because they are expensive by African standards, even with the reduction in cost elsewhere.

19. To achieve the sustainable industrialization goals, infrastructure assets that underpin industrial growth should be sustainable and withstand the vagaries of climate extremes. Building an economic infrastructure often requires massive investment in finance and human resource (skills), and it is often built over a long period. Infrastructure is supposed to serve the economy for a period usually exceeding 30 years. Critically, all infrastructure types are highly vulnerable to and are major causalities of natural disasters. Repairing infrastructure after natural disasters is often difficult and costly, which can affect industries and

¹² Kevin Urama, Energy and Africa’s Transition to a Low Carbon Economy. Climate Change: An African Agenda for Green, Low-Carbon Development. Africa Progress Panel Expert Group Meeting, October 2014.

¹³ Based on data from the Egyptian Electricity Holding Company.

other economic sectors of society negatively. African countries should therefore take into account the resiliency of infrastructure assets at the project design stages. Table 1 lists some of the possible impacts of climate variations and accompanying resilient measures.

**Table 1
Examples of climate-resilience infrastructure measures in selected transport systems relevant for Africa**

<i>Types of transport</i>	<i>Changes in climate</i>	<i>Possible impacts</i>	<i>Example resilience-building measures</i>
<i>Road</i>	Increases in very hot days and heatwaves	Deterioration of road surface integrity and thermal expansion of bridge joints and paved surfaces	Enhance design criteria to withstand extreme heat
	Increase in intense precipitation events	Damage to road infrastructure due to landslides and overloading of drainage systems, leading to flooding	Improve emergency repair procedures and upgrade drainage systems
	Increase in drought	Damage to road infrastructure due to increased susceptibility to wildfires	Install fire barriers beside roads
<i>Rail</i>	Increase in average and extreme precipitation	Erosion of rail beds	Improve drainage around rail beds
	Increase in extreme temperature	Thermal expansion of rail causing buckling	Enhance design criteria of rails
	Increase in extreme temperature	Greater cooling requirements in underground railway systems	Improve air cooling systems
<i>Airports</i>	Increases in very hot days and heatwaves	Deterioration of runway surface integrity	Enhance design criteria
	Increase in intense precipitation events	Surcharging of airport drainage systems, leading to flooding	Expand drainage system capacity

Source: Adapted from World Bank, *Emerging Trends in Mainstreaming Climate Resilience in Large Scale, Multi-sector Infrastructure PPPs: A Global Knowledge Product*.

III. Policy analysis and recommendations

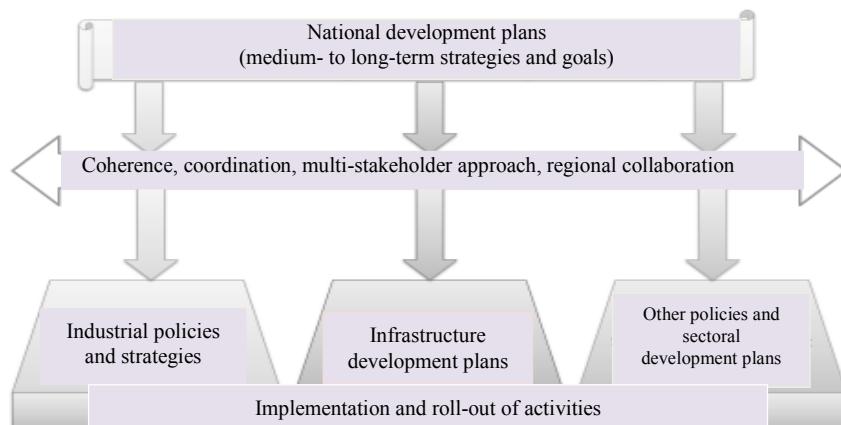
A. Integrated policy framework and the promotion of infrastructure and industrial development in Africa

20. Policy development (from planning to design and implementation) that supports quality infrastructure and industrial development in Africa requires effective planning and strong coherence in the strategic plans and policies of countries. It has to begin with a clear identification of the types of infrastructure needed to support industrial development paths. Developing policies needs strong collaboration between local, national, regional and international level entities to maximize synergies. This entails strong leadership at the country level that brings together various stakeholders in and outside the countries in an integrated manner. The policy framework should primarily emphasize medium-term to long-term development plans, while limiting the focus on the so-called

“ambulance” policymaking, which tends to focus solely on immediate social issues.

21. Championing industrialization in Africa through an integrated policy framework begins with medium-term to long-term development plans (see figure II). These plans would translate into different policies, such as industrial policies and infrastructure development road maps with clear objectives and expected outcomes. The policy framework must benefit from dynamic consultations between relevant actors, including government agencies, the private sector, academia, local communities and regional and international partners. This participatory approach accounts for all stakeholders’ interests and, therefore, contributes to minimizing conflicts in the policy development process. Coordination and collaboration are also critical to maximize synergies between national and regional programmes, especially in the context of a number of cross-border infrastructure projects that are under development throughout Africa.

**Figure II
An example of an integrated policy framework**



B. Capacity-building on infrastructure and industrial development

22. African Governments urgently need to deal with capacity constraints at all levels. Capacity gaps impede Governments in designing and implementing appropriate policies, while skills gap and mismatches remain a hurdle for infrastructure and industrial development projects. Integrated policy development requires strong institutional capacity and technical skills of all concerned. These capacities should cover various stages of the project cycle. Having suitable capacities are important in order to plan, prepare, analyse, budget and conduct financing negotiations around projects, especially in Governments. Africa would need to develop more innovative service delivery mechanisms that promote support for projects design and management and institutional strengthening. The Continental Business Network, led by the New Partnership for Africa’s Development (NEPAD), for example, acts as an exclusive infrastructure investment advisory platform for African leaders. It provides leadership and engagement on a range of strategic issues, such as policy, investment risk rating and project structuring. NEPAD has instruments to carry out the outcomes of the Dakar Financing Summit for Africa’s infrastructure. Of those is the Programme for Infrastructure Development in Africa service delivery mechanism, designed to endow projects’ owners with the skill required for early-stage project preparation.

23. Skills gaps and skills mismatches hold back infrastructure and industrial projects in many African countries. It remains critical to develop national education and training systems, while increasing participation rates at the tertiary-level education, in particular for science, technology, engineering and math subjects, just as improving the access of young people to high-quality technical vocational education and training. There should be training programmes tailored to the need of industries, in particular small and medium-sized enterprises, which contribute a great deal to employment and local value added. There is also need for technology-focused incubation programmes to foster local tech entrepreneurship.

C. Economic zones model to overcome infrastructure bottlenecks

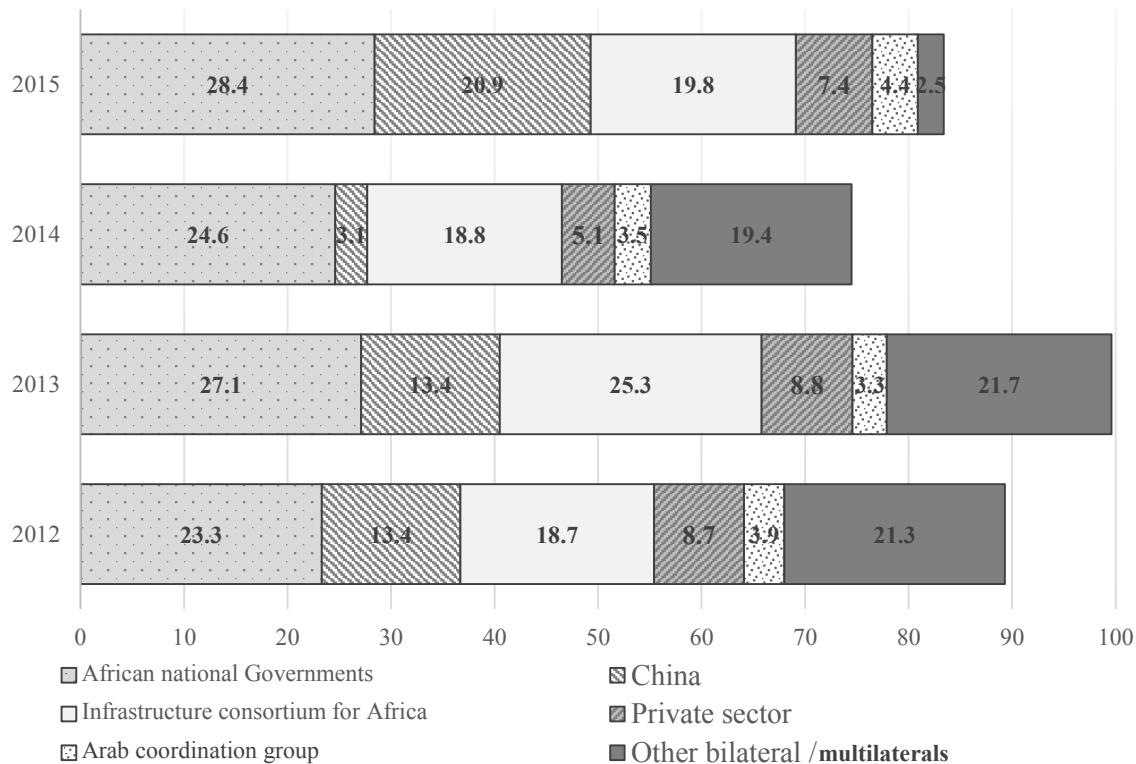
24. The geographical proximity of industries through the development of economic zones, such as industrial parks, special economic zones and technology parks, remain a viable way for Africa to optimize infrastructure development for its manufacturing sector. This is also critical to circumvent the persistent and significant infrastructure constraints on the continent. Furthermore, the economic zones yield several benefits, such as economies of scale in infrastructure and services, the transfer of knowledge and technologies, and ease of access to labour and other inputs to businesses.

25. African countries could learn from the experiences of current success stories on the continent (Egypt, Ethiopia, Kenya and South Africa, to cite a few) and beyond (China, Malaysia and Vietnam), while drawing lessons from past unsuccessful experiences. The success of economic zones depends on several factors. These are an enabling regulatory environment, the existence of quality infrastructure systems, strong linkages to national and regional economies and good location, preferably close to urban centres with good connectivity to regional markets. Whenever feasible, Governments should support informal industrial clusters that could emerge because of the informal agglomeration of small and medium-sized enterprises. Evidence points to an informal cluster of businesses that can transit to the formal sector with adequate government support, such as improving their linkages to larger firms and increasing their connectivity to national and regional markets.

D. Mobilizing private sector investment

26. Funding remains one of the main hurdles for developing resilient infrastructure and promoting sustainable industrialization in Africa. There is notable low involvement of the private sector (see figure III). This leaves the public sector, with its limited capacity, and development partners to provide the bulk of infrastructure funding. Several actions are needed to attract private finance into Africa's infrastructure and industrial development projects.

Figure III
Infrastructure financing in Africa, by source, 2012–2015
(Billions of United States dollars)



Source: Infrastructure Consortium for Africa, *Infrastructure Financing Trends in Africa 2015*.

27. First, the Government's role in providing an attractive and sound regulatory environment for infrastructure funding remains critical. This is usually done through a transparent policy framework that results in road maps, which identify projects that can mobilize private sector participation, preferably under public-private partnership arrangements. For example, projects with the highest returns on investment could primarily target private investment. It is also the responsibility of Governments to establish an order of priority projects, while developing and selecting bankable and investible projects, for example, priority given to national projects embedded in transboundary infrastructure programmes that have great potential in terms of being bankable, while targeting infrastructure needs common to neighbouring countries and fostering regional integration. To contribute to sustainable and inclusive development requires selecting infrastructure and industrial projects on the basis of the economic, social and environmental opportunities that they represent. It is important for a policy framework that targets investment in infrastructure to be stable and driven primarily by long-term strategic development plans. Infrastructure development policies should correspond to the time frame of infrastructure projects that often span, on average, between 20 and 30 years. This would also contribute to reinforcing mutual trust, which is crucial for long-term partnerships between Governments and the private sector.

28. Second, Africa could finance its infrastructure projects by channelling remittances of billions of dollars annually, just as mobilizing resources from financial markets. Non-traditional investment, such as pension and private equity funds, can also be oriented towards infrastructure projects. Achieving these objectives would require clear, simple, stable and transparent regulatory

and legal frameworks to encourage investment and support an overall sustainable approach to infrastructure and industrial development.

29. Third, African countries should also consider devising projects that help them to tap into regional and global resilient infrastructure funds managed by the African Development Bank (AfDB) and the Work Bank. These funds support countries in achieving the Sustainable Development Goals and the objectives of the Paris Agreement on climate change through resilient and green infrastructure. For example, the Climate Investments Funds help developing countries to achieve low-carbon and climate-resilient development through grants, concessional loans, risk mitigation instruments and equity. Countries could also tap into the possibilities offered by the UNIDO Programme for Country Partnerships. The programme supports Governments in mobilizing public resources targeting large-scale infrastructure projects for industrial development, mobilizing additional investment from the private sector in industrial activities and creating multi-stakeholder partnerships that allow for coordinated actions and synergies with interventions relevant to industrial development.

30. Lastly, the efforts of African countries to scale up investment in infrastructure could be complemented by mobilizing domestic revenue, achieved by preventing tax evasion, reforming and modernizing tax systems and combatting illicit financial flows of more than \$50 billion annually.

E. Renewable energy for low-carbon industries

31. Renewable energy has a critical role to play in powering Africa's industries and in creating industries along the low-carbon development path, often referred to as "green growth". More importantly, prices for renewable technologies, especially solar and wind power, are falling at an extraordinary rate to the point that they are competitive with fossil fuels. There are positive signals on green investment in Africa. Ethiopia, Ghana, Kenya, Morocco, Nigeria and South Africa, among others, are developing very large power generation plants that use renewable energy. The potential of hydro, solar, wind and geothermal present huge supply-side market opportunities for low-carbon technology development and transfer.

32. The decentralized nature of many renewable energy technologies ensures the provision of power to rural or cottage industries. Current investment in renewables, in particular in off-grid systems, however, is very low in almost all African countries. Grid-connected systems are preferred, yet very few rural areas have access to national grids. Accordingly, the recommendation is that African countries set up dedicated funds for rural electrifications, focusing on modular stand-alone systems to power vast rural areas. In this way, such power will be available for rural industries, including agriculture and small and medium-sized enterprises. It is notable that some countries have rural electrification funds, but these have to be escalated and the capacity to manage and execute off-grid systems be built over time.

33. Renewable energy is undeniably a great source of job creation. There is emerging evidence in Africa (e.g., in Egypt, Morocco and South Africa) that the benefits of renewable energy to job creation are unmatched. With the anticipated focus on new and renewable energy in Africa, the prospects for jobs are huge, but there has to be institutional realignment for this to take place. This involves setting up national systems of innovation or centres of excellence to provide technical training to reskill many of the job seekers in their chosen renewable technologies, in particular solar energy technologies, of which most African countries have a competitive advantage. The three-pronged Moroccan

approach of building skills and expertise could provide useful lessons on how to approach the reskilling of the workforce.

F. Planning climate resilient infrastructure assets

34. Save for very few instances, there was no strong evidence of climate resilience planning in infrastructure development in Africa. Huge investment is usually made on infrastructure with the understanding that such assets will boost industrialization and local manufacture on the continent. All infrastructure assets, in particular power lines, roads and bridges, railway lines and ports, however, are highly susceptible to extreme climatic conditions. There are anecdotal accounts of recently damaged roads and other infrastructure because of floods in many African countries. It normally takes even more financial resources to replace such infrastructure, not to mention the short-term to medium-term impacts that the damage has on local industries. It is assumed that integrating climate resilience planning into infrastructure development on the continent could lead to additional costs but will lead to improved life cycle costs.

35. Accordingly, it is important to approach this from two angles. The first is to assess the resilience of current and recently deployed infrastructure systems. Such assessments would identify areas in which resilience can be retrofitted or, at the minimum, the impact of climate could be anticipated and mitigated. The second is to mainstream climate resilience into future infrastructure projects. Doing so will require building the capacity of policymakers and project developers alike and providing funding to offset additional costs that may be incurred. Recently, ECA, together with the African Union, AfDB and the World Bank, established at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change the African Facility for Climate-Resilient Investment. The establishment of this initiative was in recognition that failure to integrate climate change into the planning and design of infrastructure could entail severe revenue losses and increased consumer expenditure for services, in particular in transport, energy and water. This Africa-based facility of technical competence and excellence will assist Governments, planners and developers in Africa in integrating climate change into project planning and design, thereby attracting climate finance from the Green Climate Funds and other sources.

36. As one of the priority actions, the African Facility for Climate-Resilient Investment should identify key infrastructure projects, in particular those under the auspices of the Programme for Infrastructure Development in Africa and develop action plans on how they can integrate climate resilience into (post facto or during) the project implementation.

G. Mainstreaming gender into infrastructure projects

37. It is acknowledged that there is no “one size fits all” approach to bridging gender inequalities and stimulating inclusive growth. If industrialization is to contribute to the eradication of poverty and inclusive and sustainable development, it should integrate gender into infrastructure programmes to ensure that women and men share equally the positive impact of economic and social transformation, including the welfare and social empowerment generated by infrastructure development. Women constitute more than half of the population in Africa, and the failure to consider the gender dimensions in infrastructure development can lead to ineffective development policies and programmes. The availability of social infrastructure investment by Governments to close the gender gap in education and training and improve

women's access to health care, especially reproductive health, cannot be overemphasized.

38. There are gender disparities in health, education and incomes associated with women's lack of access to infrastructure, and this in part explains why women remain longer and at higher levels of poverty, notably in rural areas. With regard to physical infrastructure investment by Governments, entrenching a wide range of principles in the development of roads, transport, water, sanitation and ICT will reduce women's time burden. There are well-known gender disparities in mobility and access to transport infrastructure and means of transport in Africa. Women and men have different travel needs, travel patterns, burdens and means to gain access to transport services. Women contribute up to 65 per cent of the household's travel time, fulfilling both their productive and reproductive roles. Accordingly, the importance of mainstreaming gender into transport infrastructure projects and programmes in order to enhance women's economic empowerment and well-being is crucial.

IV. Concluding remarks

39. The issues pertaining to the contribution of industrial output to infrastructure assets identified in this report are not exhaustive. Some key issues are pinpointed that should be prioritized in the context of the global and continental agenda on improving industrialization through infrastructure development, as reflected in Sustainable Development Goal 9 and several aspirations of the African Union's Agenda 2063. Infrastructure development should not be seen as isolated projects but as part of a programmatic approach that brings together various sectors and Government entities throughout and beyond countries in order to maximize synergies.

40. Moreover, Agenda 2063 and the Continental Free Trade Area provide a powerful vision to open up the African region and transform its economy for the betterment of their citizens, in particular the latter, which is intended to create a single continental market for goods and services, with the free movement of business people and investment. A successful development-oriented integration agenda will require simultaneous and coordinated efforts from African countries by opening their markets to their neighbours on the continent, building industrial capacity and investing in cross-border infrastructure. By adopting a "development integration" approach, it will go a long way in advancing the transformation and industrialization agenda of the continent, while fulfilling the vision and action plan of Agenda 2063.