UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Angola

SCIENCE, TECHNOLOGY & INNOVATION POLICY REVIEW

United Nations

UNDP

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Angola

SCIENCE, TECHNOLOGY & INNOVATION POLICY REVIEW

United Nations
Geneva, 2023

UNCTAD/DTL/STICT/2022/7

Acknowledgements

This study was prepared under the overall guidance of Shamika N Sirimanne, Director, Division on Technology and Logistics, UNCTAD, by a team comprising Clovis Freire (team leader and Chief, Technology and Innovation Policy Research Section, UNCTAD), Ludovico Alcorta (Professorial Fellow, United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology), Ermelinda Liberato (Assistant Professor, Agostinho Neto University, Angola) and Antonio Vezzani (Associate Professor, Rennes School of Business, France).

The study benefited greatly from comments and suggestions provided by Angel Gonzalez-Sanz (Head, Technology, Innovation and Knowledge Development Branch, UNCTAD) and Lorenzo Mancini (Economist, United Nations Development Programme Angola). Comments from stakeholders in Angola were provided during an online seminar held on 19 May 2022.

The study would not have been possible without the support of Domingos da Silva Neto (Secretary of State for Science, Technology and Innovation) and Jone Heitor (Adviser to the Minister) at the Ministry of Higher Education, Science, Technology and Innovation, Angola.

Contributions are gratefully acknowledged from the United Nations Development Programme Angola Resident Representative, Edo Stork, whose expertise was instrumental in leading the team that was closely involved in the study, including Judite da Silva (Head, Exploration, Accelerator Lab), José Félix (Head, Inclusive Growth and Sustainable Development), Alberto Hungulo (Head, Solutions Mapping, Accelerator Lab), and Daniela Lima (Head, Experimentation, Accelerator Lab) whose collaboration in the preparation of the study was essential.

Contributions are also gratefully acknowledged from those in Angola, including government officials, university and research institute staff, private sector representatives and others, who generously gave of their time and insight to the study research team.

Note

Main text

All websites referred to in the report were accessed in October 2022.

The term “dollars” ($) refers to United States dollars unless otherwise specified.

Tables

An en dash (–) indicates that the amount is nil or negligible.

n/a indicates that the item is not applicable.

Contents

Boxes

Figures

Tables

Preface

Strengthening the national science, technology and innovation system of Angola is crucial, to meet the challenges of economic diversification, increased productivity, economic growth, global competitiveness and digital and green transitions, for a prosperous nation reflected in the improved quality of life of Angolans.

Development policies for prosperous economies are strongly linked to excellence in science, technology and innovation, and their execution is subject to global shocks. The pandemic is the most recent and striking example of the role of science, technology and innovation in facing and overcoming a crisis on a global scale.

Global challenges to human development require a permanent adaptation of science, technology and innovation policies. The national science, technology and innovation policy of Angola dates to 2011 and therefore needs certain adjustments in light of the current global challenges of Agenda 2030 of the United Nations and Agenda 2063 of the African Union.

A framework for institutional cooperation has therefore been established between the Ministry of Higher Education, Science, Technology and Innovation of Angola and the United Nations Development Programme, to begin the process of revising the national science, technology and innovation policy, also relying on invaluable support from UNCTAD, to strengthen the innovation and entrepreneurship ecosystem in Angola, a fundamental contribution to achieving the Sustainable Development Goals.

The first product of the cooperation between the Ministry, the United Nations Development Programme and UNCTAD is the diagnostic study on entrepreneurship and innovation in Angola, constituting an indispensable tool to initiate the review of the national science, technology and innovation policy, leading to knowledge-based sustainable development.

The study herein is detailed and contains elements on the state of the innovation and entrepreneurship ecosystem in Angola, with a mapping of the main actors and partners that integrate and influence the national science, technology and innovation policy, as well as the evaluation of existing good practices, opportunities and challenges, culminating in a set of essential recommendations.

With this focus, this work, which is easy to follow, aims to contribute to the decision-making of the main actors of the innovation and entrepreneurship ecosystem in Angola.

Luanda, 3 November 2022

MARIA DO ROSÁRIO BRAGANÇA

MINISTER OF HIGHER EDUCATION, SCIENCE, TECHNOLOGY AND INNOVATION

Foreword

The Government of Angola seeks to stimulate entrepreneurship and innovation, to foster innovative businesses and create jobs for the young population. In this context, in 2021, the Ministry of Higher Education, Science, Technology and Innovation and the United Nations Development Programme Angola requested support from UNCTAD in the preparation of a study on innovation and entrepreneurship in Angola. The study represents a necessary step in policy development and in collecting information to be made publicly available to actors in the national innovation system.

UNCTAD has extensive experience in preparing such diagnostic studies as part of its programme on science, technology and innovation policy reviews; by end-2021, 17 reviews had been produced, including one of Angola in 2008. The reviews are an analytical and policy-learning process for national science, technology and innovation stakeholders in understanding the key strengths and weaknesses of the national innovation system and identifying strategic priorities for its development. Results of the process are documented in the review report and considered at sessions of the Commission on Science and Technology for Development.

The present review is focused on the national innovation system, innovative entrepreneurship and a mapping of the national innovation ecosystem and new digital technologies. Policies under the responsibility of the Ministry of Higher Education, Science, Technology and Innovation are considered, along with all government interventions that have an impact on innovation. The focus on innovation is directly linked with economic diversification, namely, the expansion of productive capacities, to produce goods and services that are new to the country, and the associated generation of jobs.

T**he review is based on relevant data and on interviews with 33 representatives of the Government, the private sector, academia and specialized public institutions, conducted in two phases in April–May 2021 and October 2021–January 2022, most of which were conducted online.** The interviews received the full support of the Ministry of Higher Education, Science, Technology and Innovation, the United Nations Development Programme Angola and other stakeholders.

Abbreviations

FDI	foreign direct investment
GDP	gross domestic product
ICT	information and communications technology
STI	science, technology and innovation

Key messages

Angola has made significant progress in setting up a national innovation system. The focus could now be on making the system more fit for purpose.

There is a need to change the strategic orientation towards science, technology and innovation (STI), to give as much emphasis to technology and innovation as that given to science. This requires a coordination mechanism across government agencies and between government agencies and the private sector, and the building of an environment that fully supports the domestic entrepreneurial ecosystem. STI policies should have a rebalanced focus, towards technology and innovation as pull factors, to reinforce science and research capabilities. This will allow for an upgrading of the science and innovation system. Angola needs competent engineers and technicians in key areas of industrial production, to support the diversification process, as well as business-oriented professionals, to drive innovation. The education system should be able to provide such professionals, as demanded by the private sector.

Technology adoption and innovation need to be prioritized, for economic diversification. There have been improvements in the business environment for innovation, such as in reductions of the time needed to open a business or an increase in Internet accessibility. Building on this initial success, additional efforts should be made to strategically support priority sectors with greater potential for growth, structural change, productivity enhancement and sustainable outcomes. This requires a strategy that combines diversification with import substitution (of items such as food products, plastics and chemical products) and with export promotion (focused on the African Continental Free Trade Area and the African Growth and Opportunity Act).

STI policies need to be considered as a tool of industrial and economic policies. Angola is at an early stage of technological and industrial development, at which STI policies and policy interventions should be demand-driven, focused on providing the human capital and technological support required to build domestic technological and productive capacities. In this regard, strong linkages should be formed between STI and industrial policies and initiatives.

There should be a focus on supporting and strategically stimulating the private sector. Domestic firms need to obtain and absorb new technologies. In addition, they require support in finding and contracting such technologies and incentives to ensure that they are adopted and assimilated into the local economy through learning, linkages and demonstration effects. This requires the Government to be seen as a partner of business, supporting the private sector in acquiring and developing technology through a demand-driven approach.

Angola needs to increase short-term and long-term finance for the national innovation system. In the short term, a greater budget should be allocated to certain elements, and more work with international partners and donor countries could lead to some additional funding. However, the main area of expansion of finance for STI should come from the private sector, through higher levels of investment in research and development and innovation by large firms and through the banking system, by lessening conservative lending practices. A rapidly expanding economy and manufacturing industry would contribute greatly to this goal.

The push for technological learning, innovation and economic diversification should come from the highest levels of Government. In countries that have been successful in technological and economic catch-up, monthly or quarterly meetings were convened with the participation of representatives from the Government, the private sector and academia at the highest levels, which provided a higher level of institutional support for efforts in technological learning and innovation, as well as for the greater coherence of such efforts. The tasks faced by Angola require a similar level of engagement and commitment.

1. National development goals and the role of innovation

1.1 Introduction

In 2008, UNCTAD conducted an STI policy review in Angola, focused on priority sectors such as mining, agriculture, information and communications technology (ICT) and manufacturing (UNCTAD, 2008). The review identified the main constraints in these sectors and provided recommendations as to how to overcome them, focusing on innovation issues. However, it was not possible, in the subsequent period (2008–2021), to overcome all of the difficulties noted nor to take up all of the recommendations. Some of the deficiencies that had been noted therefore persist.

At the same time, the present situation differs from that in 2008. In the subsequent period, new challenges arose, others remained and others became outdated. In 2008, also a period of global crisis, the political discourses on innovation and economic diversification were already a reality, although low-key. Angola has been experiencing an unprecedented economic and financial crisis, which dates to 2014 and lasted until the start of 2021; signs of recovery have been recorded by the National Institute for Statistics since the second (+1.2 per cent) and third (+0.5 per cent) trimesters of 2021. Discourses on innovation and economic diversification have become more active and the pressure has become greater, placing the agricultural and industrial sectors at the centre, along with the issue of the qualification of human resources, to meet the demands of both.

In the present review, what has been done, what is planned and prospects for the future are examined, and what may be hindering the development of the national innovation system, the new investments being made and the new sectors that could be promoted are discussed. The analysis, discussion and recommendations are based on relevant data and on interviews with 33 representatives of the Government, the private sector, academia and specialized public institutions, conducted in two phases in April–May 2021 and October 2021–January 2022.

1.2 National economic trajectory

External economic conditions have significantly affected the economy of Angola, as has occurred in many other commodity-dependent countries. The economy of Angola experienced a period of rapid expansion following the establishment of peaceful conditions at the beginning of the 2000s (UNCTAD, 2008). In 2004–2008, gross domestic product (GDP) per capita increased at rates of 7–10 per cent. However, the rapid expansion of the economy was interrupted by the global financial crisis of 2008/09, the uncertain performance of the global economy and the reduction of trade. The year 2020 was the sixth year in a row in which GDP per capita decreased (figure 1); the signs of recovery noted above have not yet been captured in international statistics. In addition, the pandemic affected a fragile economy that had already been experiencing a period of low or decreasing growth rates. In 2020, Angola registered a decrease in GDP per capita of about 7.5 per cent, due to the difficult situation triggered by the pandemic, which resulted in limited mobility across the country, a decrease in demand for oil coupled with low international prices and a general stagnation in the import and export of commodities.

The pandemic significantly affected exports (-39.7 per cent in 2020) and imports (-32.4 per cent), which resulted in a record drop in the trade balance (-44.5 per cent) and in the balance of payments, which fell from $5 billion in 2019 to $872 million in 2020, although this was higher than the negative balances in 2014–2017. However, in 2021, both imports and exports rebounded to values close to those from before the pandemic (table 1).

Figure 1

Angola: Gross domestic product per capita growth rates
(Percentage)

Source: UNCTAD calculations, based on data from the UNCTADstat database.

Table 1

Angola: Trade and current account
(Millions of current dollars)

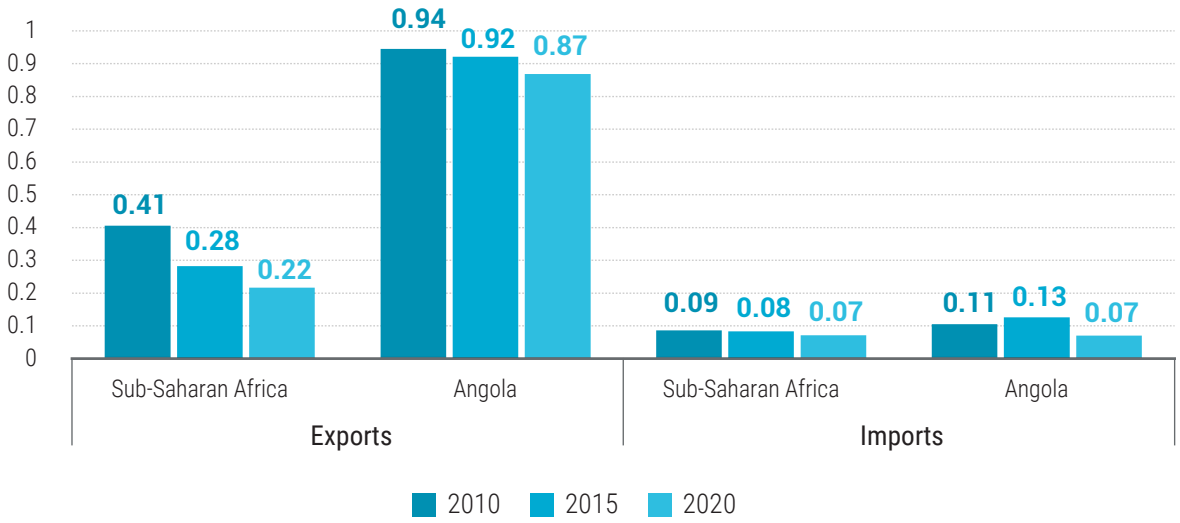
	2010	2015	2018	2019	2020	2021
Exports	50 595	33 181	40 758	34 726	20 937	33 337
Imports	16 667	20 693	15 798	14 127	9 543	12 777
Trade balance	33 928	12 489	24 960	20 599	11 394	20 560
Current account balance	7 506	-10 273	7 403	5 137	872	n/a

Source: UNCTAD calculations, based on data from the UNCTADstat and World Development Indicators databases.

Vulnerability to external shocks raises concerns about the development model of the economy of Angola, which remains dependent on the performance of the oil and mining sectors. The concentration of exports from Angola is one of the highest in the world and is much higher than those of other sub-Saharan economies (figure 2). The low level of development of the non-oil economy (such as manufacturing or agribusiness) and low levels of productivity result in a significant level of dependence on imports to meet the internal demand for many (basic) commodities. Angola, along with other sub-Saharan countries, needs to import a differentiated array of products and services that the economy cannot internally produce efficiently. This leaves Angola exposed to shocks on the import side; the inflationary pressure at the global level might have a significant negative impact on the country's performance in 2022.

At the start of the pandemic, several countries put in place containment policies on food exports, which posed new challenges for food supply chains, with significant reductions in production and transportation that affected household income and consumption (Sers and Mughal, 2020). A similar disruption was faced with regard to other commodities, such as medical supplies. Such disruptions resulted in recognition of the need to reconsider the current trade model (Gereffi, 2020). In addition, a new set of international support measures is required, aligned with the overall objective of fostering the development of productive capacities aimed at achieving structural transformation, fostering coherence and synergy between different measures, targeting climate change and

Figure 2
Export and import concentrations



Source: UNCTAD calculations, based on data from the UNCTADstat database.

digitalization and strengthening the accountability of the least developed countries and partners through a new multilateral governance framework that allows for monitoring and evaluation, for greater transparency in international support measures (UNCTAD, 2022a).

Angola has also recently experienced an increasing geographical concentration of exports. The export performance of Angola is significantly affected by a decreasing number of countries, thereby exposing the country to regional and global shocks. In 2011, 35.6 per cent of exports were directed to China; 22.5 per cent, to the United States of America; and about 10 per cent, to India (table 2). In 2019, the year before the pandemic, over 60 per cent of exports were directed to China and over 70 per cent, to countries in Asia; similar figures were recorded in 2020. In less than 10 years, the geographical profile of exports from Angola has significantly changed, in part determined by the technological development of the oil industry and the "shale revolution". The introduction of new extraction techniques combining hydraulic fracturing and horizontal drilling has enabled the United States, a former leading destination for oil from Angola, to significantly increase the production of oil and natural gas and thereby reduce the level of imports.

Table 2
Angola: Top five export destinations as share of total exports
(Percentage)

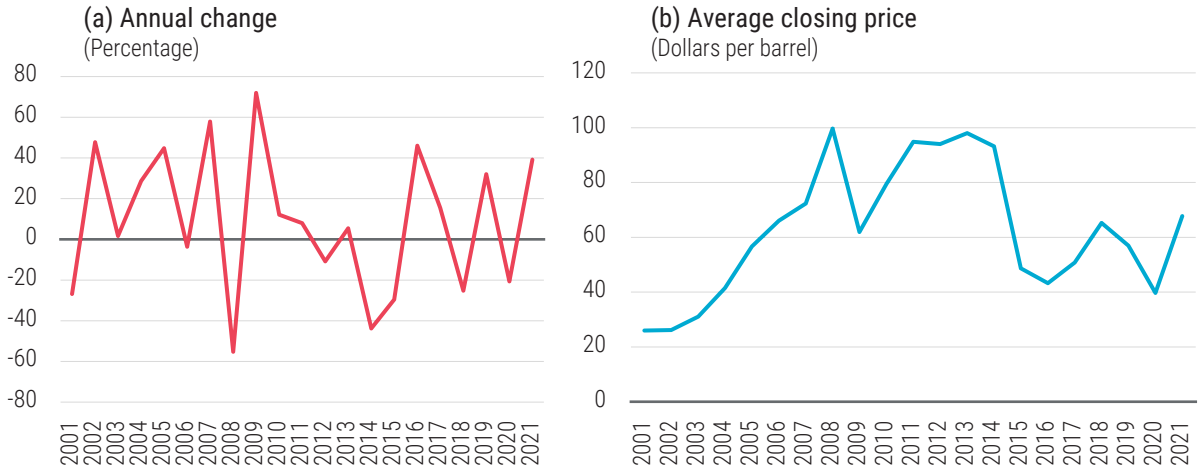
2011		2015		2020	
China	35.6	China	39.9	China	60.5
United States	22.5	India	7.9	India	8.5
India	9.7	Spain	5.9	Thailand	5.3
Taiwan Province of China	7.1	United States	5.5	United Arab Emirates	4.9
France	3.0	United Arab Emirates	4.8	Taiwan Province of China	2.1

Source: UNCTAD calculations, based on data from the Observatory of Economic Complexity.

The significant dependence on the oil sector exposes Angola to price and external demand volatility. Since the global financial crisis of 2008/09, oil prices have been characterized by a high level of volatility, with several annual negative percentage changes (figure 3). Due to the slowdown

in global economic growth and the increase in supply due to technological advancements, oil prices in recent years have been lower than those registered before the financial crisis. Current geopolitical tensions and a growing mismatch between supply and demand have once more raised prices. This trend may be transitory, and it is unclear how it will affect global production and technological shifting to less oil-demanding solutions. For example, disruptions due to the war in Ukraine may have an impact on oil prices in the short term, yet this can be absorbed through strategic reserves and, in the longer term, through an increase in production by member countries of the Organization of the Petroleum Exporting Countries (*The New York Times*, 2022). In addition, high oil prices may accelerate the uptake of alternative solutions (e.g. electric vehicles), thereby further limiting the probability of high prices over a long period.

Figure 3
Crude oil prices



Source: UNCTAD calculations, based on data from Macrotrends.
Note: Annual changes are computed using yearly opening and closing prices for West Texas Intermediate.

1.3 Challenges to sustainable development

The cost-of-living crisis, aggravated by the pandemic, has reaffirmed the need to diversify the economy and find new strategies and new resources that allow for growth and ensure the economic and social well-being of families in Angola. The significance of impacts depends on the duration of the crisis and the strategies countries adopt in its aftermath. During the pandemic, countries in sub-Saharan Africa reallocated resources and instituted lockdown measures, to help mitigate the health-related impacts of the pandemic. Such measures might have had an impact on socioeconomic performance and progress towards achieving the Sustainable Development Goals. Countries have shown different levels of resilience to the crisis, partly due to structural features.

With an estimated population of 30 million (National Institute for Statistics, 2016), mostly young, the challenges and pressures placed on the Government of Angola to change increasingly unequal scenarios are significant. Increasing unemployment directly impacts the poverty rate and the degradation of living conditions. According to recent estimates, 41 of 100 Angolans, mostly in rural areas, have a level of consumption below the poverty line (National Institute for Statistics, 2020). In addition, in 2008–2018, the share of the population living on less than $1.90 per day increased and expenditure related to health-care goods and services decreased (table 3).

Table 3
Angola: Poverty and health

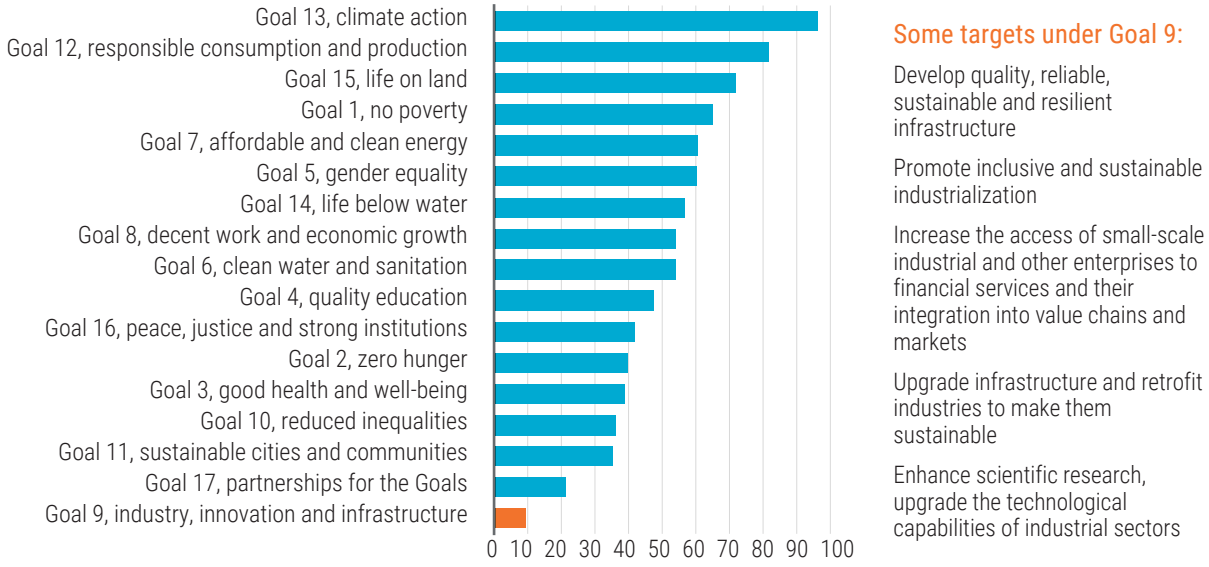
	2008	2018	Difference
Population living on less than $1.90 per day (2011 international prices; percentage)	34.4	49.9	+15.5
Population living on less than $3.20 per day (2011 international prices; percentage)	60.6	71.5	+10.9
Health expenditure as share of GDP (percentage)	3.32	2.54	-0.78
Health expenditure per capita (current dollars)	136	87	-48 (-36 per cent)

Source: UNCTAD calculations, based on data from the World Development Indicators database.

Sustained, inclusive and sustainable economic growth is essential for prosperity and requires the building of solid socioeconomic foundations. Action in Angola towards achieving the Sustainable Development Goals has been based on National Development Plan 2018–2022, a strategic plan that provides the basis for the implementation of the long-term strategy for development (Angola 2025). Overall, the strategy is aimed at improving basic conditions, to counter situations of hunger, poverty and vulnerability. Among the medium-term to long-term challenges, Angola aims to accelerate economic diversification, reduce structural vulnerability, improve the quality of education and professional skills among youth and sustain technology transfer to promote more sustainable and resilient development.

In this regard, addressing the targets under Goal 9 is critical, because innovation and the modernization of industry are drivers of economic transformation that is at the centre of economic and social development and poverty reduction. However, on progress in achieving the Sustainable Development Goals, Angola has the lowest score with regard to Goal 9 (figure 4). Setting an effective strategy to meet the targets under Goal 9 is therefore particularly relevant in Angola. This situation reinforces the need for urgent change in economic and social realities, structural reform and public policies, to diversify the economy, create jobs, export more and import less.

Figure 4
Angola: Sustainable Development Goals index



Source: UNCTAD calculations, based on Sustainable Development Solutions Network and Sustainable Development Goals Centre for Africa, 2020.

1.4 Importance of innovation and economic diversification

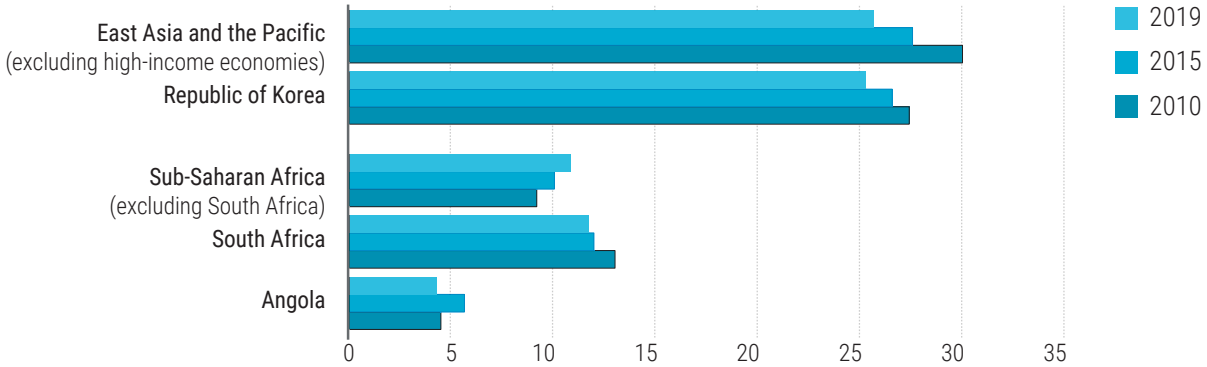
It is crucial to focus on innovation and entrepreneurship in a knowledge-based and innovation-led economy. New, innovative firms and the development of strategic industries favour the process of creative destruction leading to those changes in the economy that form the basis of the development process. Without progress in the sphere of innovation and the creation of new and more productive jobs, ending poverty might be even more challenging, and hunger will remain a threat to large parts of the population. A diversified and modern economy increases opportunities for further economic development. It also contributes to keeping the economy on a stable growth path rather than leaving it exposed to internal and external conjunctural factors (shocks).

A process of economic diversification through the development of the manufacturing and agribusiness sectors represents the most promising option for ensuring sustained growth in Angola, as well as for increasing resilience to external factors. Diversification could trigger a modern economic growth process fuelled by structural transformation involving innovation in existing industries and diversification through the emergence of new, high(er) value added industries (Lin et al., 2020). This is particularly relevant in Angola because of the dependence on oil. Commodity dependence is persistent and difficult to emerge from. Policy interventions to improve technological capacities therefore need to focus on increasing labour productivity in the manufacturing sector and promoting export diversification (UNCTAD, 2022b). Policy interventions should also focus on innovative mechanisms for financial services and the private sector, to drive incentives for diverting economic activities into transformative sectors (UNCTAD, 2022c).

In this regard, Angola needs to increase the share of manufacturing value added, which is low, to put national development onto a sustained growth path. In Angola, the share of manufacturing value added in GDP is low, and decreased in 2015–2019, reaching a lower value than after the global financial crisis of 2008/09 (figure 5). With values at around 5 per cent, the contribution of the manufacturing sector to GDP is half the average among sub-Saharan countries and significantly less than that in, for example, South Africa. The gap between Angola and countries in East Asia and the Pacific is significant. The latter economies experienced or are experiencing a period of rapid growth allowing for partial closure of the gap between these economies and developed economies. The catch-up process has largely been based on the creation and development of competitive manufacturing industries that account for 25–30 per cent of GDP. The majority of the difference between the productivity performance of countries in Africa and Asia is therefore accounted for by differences in the pattern of structural change; in countries in Asia, labour has been moving from low-productivity to high-productivity sectors, yet this process has not taken place in Africa (McMillan and Rodrik, 2011).

Figure 5

Manufacturing value added as share of gross domestic product
(Percentage)



Source: UNCTAD calculations, based on data from the World Development Indicators database.

Angola also needs to increase the productivity of the agribusiness industry. In 2010–2020, the shares of agriculture, forestry and fishing in the economy increased from 6.2 to 9.5 per cent. However, the sectors remain characterized by a low level of productivity and by the lack of organized structures connecting production fields with existing processing plants. The lack of infrastructure and poor logistics lead to high transaction costs that do not allow for modernization and the emergence of a modern agribusiness industry. Compared with other developing countries and the average of other countries in sub-Saharan Africa, Angola is underperforming in providing access to electricity, particularly in rural areas, and in the quality of trade and transport-related infrastructure (table 4).

Table 4
Infrastructure indicators

	Angola	**Sub-Saharan Africa** (excluding South Africa)	**East Asia and the Pacific** (excluding high-income economies)	**Latin America and the Caribbean** (excluding high-income economies)
Access to electricity, total population (percentage)	45.3	45.8	97.7	97.6
Access to electricity, rural population (percentage)	7.3	27.3	96.2	90.1
Trade and transport infrastructure score (1 (low)–5 (high))	1.9	2.2	2.6	2.5

Source: UNCTAD calculations, based on data from the World Development Indicators database.

The development of new industrial sectors would have a multiplier effect on the economy. When a local economy generates a new job, the resulting income and increased demand for local goods and services create additional jobs. One extra job in manufacturing may create 1.6 jobs in the local economy, and the increase among skilled (better paid) jobs and innovative industries may be much higher (Moretti, 2010). The Government and the financial sector should support the creation of new and profitable facilities, and the resulting revenues should be reinvested in the economy, to guarantee an expansive cycle.

Stable and continued growth that favours the transition of Angola towards a more advanced economy, catching up with more developed economies, requires the modernization of the agricultural sector and the development of a modern and diversified manufacturing sector.

1.5 Overview of government initiatives for promoting innovation, entrepreneurship and diversification of the economy

The low level of representation and the fragility of the non-oil sector, with an emphasis on agriculture and industry, means that the State takes a central position in all economic activity. This conditions dynamics and, consequently, the ability to modernize, innovate and become competitive and productive. The Government of Angola, as a priority in the legislature in 2017–2022, aimed to elaborate, approve and implement policies and programmes to correct deviations, improve actions already taken and guide and consolidate the right path. International, regional and national guidelines help safeguard the structural reforms adopted. At the international level, Angola is committed to implementing the Sustainable Development Goals and at the regional level, Agenda 2063 of the African Union highlights the industrialization and modernization efforts of Africa and emphasizes the importance of valuing agriculture so that it is modern, to increase production and productivity and increase value, to contribute to the prosperity of the farmer and at the national level and to food security (African Union, 2015). The informal economy is regarded as a determining aspect in several

areas of intervention. In addition, the Southern African Development Community Industrialization Strategy and Road Map 2015–2063 is also applicable at the regional level. At the national level, there are two main guiding documents, namely, the long-term strategy for development (Angola 2025), which establishes the need to define policies to promote the access of all Angolans to productive, qualified, remunerated and socially useful employment and to ensure the sustained valorization of national human resources; and National Development Plan 2018–2022, which includes measures aimed at, inter alia, promoting employment, creating small and medium-sized enterprises and protecting workers' rights. The plan has 25 strategic policies and six priority areas of intervention, namely human development and well-being; sustainable, diversified and inclusive economic development; infrastructure needed for development; peace-building, strengthening democratic institutions, good governance, State reform and decentralization; harmonious development of the territory; and stability and territorial integrity of Angola and strengthening of the role of the country in international and regional relations.

The proposals for reforms presented, approved and undertaken include macroeconomic adjustment; tax reform; exchange rate reform, which resulted in the liberalization of the exchange rate and, consequently, depreciation of the national currency; measures for the attraction of foreign direct investment (FDI), with a view to approving normative documents (laws on privatization and private investment); and public policies to improve the investment environment. The Government of Angola has implemented and created several policies, programmes and institutions to promote industry, innovation and infrastructure under National Development Plan 2018–2022, as follows:

- National STI Policy, aimed at harnessing STI for the implementation of the national development strategy
- National Industrial Development Plan 2025, which systematizes the policy guidelines that structure the intervention of the Government in the manufacturing industry sector and identifies concrete steps for the implementation of the strategic policies of the Plan, in particular, the policy for enhanced production, export diversification and import substitution and the policy for quality, innovation and technology
- Production Support, Export Diversification and Import Substitution Programme (PRODESI), which is the main economic development instrument of Angola and was launched in 2018. It may be the most ambitious among the reform programmes, given the economic and financial situation in the country and the pressure for change. Diversifying exports and replacing imports present significant challenges, given the economic, political and social transformations experienced in the country since 1975. The reform plan under the Programme is aimed at fostering a more attractive, transparent and dynamic economy, reducing administrative costs, ensuring brevity and speed in service and reforming the regulatory documents that manage economic activities
- Credit Support Project, created in 2019 to finance projects under the Production Support, Export Diversification and Import Substitution Programme (PRODESI). The project aims to finance investment projects that contribute directly or indirectly to the domestic production of goods, thereby reducing the need for imports. To this end, a list has been published of the 54 articles covered, as well as the eligible operations and the amount of credit approved (Government of Angola, 2022)
- Foundation for the Development of Science and Technology, created in 2021 to implement STI policies, manage government outlays dedicated to research and development and accredit institutions performing research and development. In 2022, the foundation issued a call for university professors, scientific researchers and managers of institutions and research projects, as well as for higher education institutions, research and development institutes and, in general,

actors in the national STI system, to submit projects related to research and institutional development (Ministry of Higher Education, Science, Technology and Innovation, 2014a)

- Action Plan for the Promotion of Employability, managed by the Ministry of Public Administration, Labour and Social Security, with the primary objective of implementing programmes and projects aimed at increasing employability and thereby reducing unemployment (currently estimated at 30.8 per cent (National Institute for Statistics, 2022)), poverty and social exclusion. The main programmes are related to training to become a self-employed individual (e.g. freelancer or independent contractor); professional internships; insertion in the labour market; training in entrepreneurship and business management; and training and qualification of young people
- Integrated Municipal Intervention Plan, created in 2019 with a budget of $2 billion, to prepare for the transition to administrative decentralization and aimed at intervening in the secondary and tertiary sectors to facilitate the mobility of people and goods, including in rural areas. By the start of 2021, the plan had committed 10 per cent of its budget to supporting relevant projects (Ver Angola, 2021)
- Informal Economy Conversion Programme, created in 2020, to formalize economic activities in the informal sector, thereby providing greater dignity and protection to those performing their functions and allowing for the contribution of this sector to tax reform. The programme is supported by the European Union, which has made €14.5 million available to strengthen its operationalization

Reform in the public business sector has included the approval of the Privatization Programme, aimed at reducing the participation of the State as a direct producer of goods and services in different sectors (mineral resources and oil, ICT, finance, transport, economy and planning, hospitality and tourism, productive sectors) and at promoting private initiatives, paving the way for foreign investment and the acquisition of particular skills in each sector and increasing the quality and variety of services available to the population. The programme provides for the divestment of 195 companies and assets, of which 50 are conducted directly by Sonangol, the public oil company in Angola.

In addition, Law 10/19 of 14 May 2019 established the legal regime for the privatization and/or reprivatization of public companies, shareholdings held directly by the State or other public entities and other assets and public assets when considered in isolation; and changes aimed at removing FDI barriers were made to private investment laws (Law10/18 of 26 June 2018 and Law 10/21 of 22 April 2021).

The overall strategy to meet the targets under Goal 9 and develop the industrial and innovation systems in Angola involves the participation of several ministries responsible for particular areas (table 5).

Table 5

Angola: Sustainable Development Goal 9 framework

Year	Leading ministry	Action taken	Impact on indicators under Goal 9								
			9.2.1	9.2.2	9.3.1	9.3.2	9.5.1	9.5.2	9.a.1	9.b.1	9.c.1
2011	Ministry of Higher Education, Science, Technology and Innovation	National STI policy					■	■			
2018	Ministry of Economy and Planning	Production Support, Export Diversification and Import Substitution Programme	■	■	■	■				■	
2018	Ministry of Telecommunications, Information Technology and Social Communications	White Paper on ICT 2019–2022									■
2018	Ministry of Industry and Commerce	Programme to stimulate production in the manufacturing industry	■	■	■	■				■	
2021	Ministry of Industry and Commerce	National Industrial Development Plan 2025	■	■	■	■	■	■		■	
2021	Ministry of Higher Education, Science, Technology and Innovation	Foundation for the Development of Science and Technology					■	■			

Source: UNCTAD, based on Government of Angola, 2021.
Note: The indicators are as follows: 9.2.1, manufacturing value added as a proportion of GDP and per capita; 9.2.2, manufacturing employment as a proportion of total employment; 9.3.1, proportion of small-scale industries in total industry value added; 9.3.2, proportion of small-scale industries with a loan or line of credit; 9.5.1, research and development expenditure as a proportion of GDP; 9.5.2, researchers (in full-time equivalent) per million inhabitants; 9.a.1, total official international support (official development assistance plus other official flows) to infrastructure; 9.b.1, proportion of medium and high-technology industry value added in total value added; 9.c.1, proportion of population covered by a mobile network, by technology.

1.6 Way forward

The Government of Angola is making efforts to overcome the current period of crisis and modernize the economy, to make it more sustainable and decentralized, creating the conditions for increasing private investment, making room for private initiatives and, above all, diversifying the economy. Coordination and collaboration among ministries constitute a crucial aspect in determining the success of the overall strategy.

2. Angola: Status of science, technology and innovation

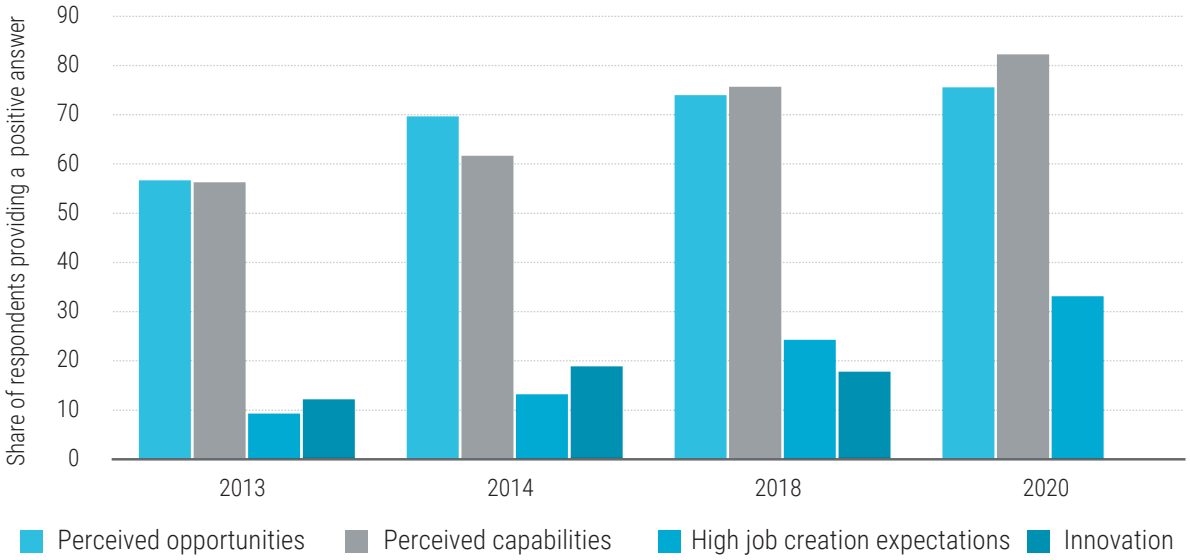
2.1 Entrepreneurship and firm-level innovation

Innovation should not be seen only as the results of research and development-oriented activities but should be conceived from a broader perspective that includes innovation through imitation and the creation of products that are new to the firm or the country, but not necessarily new in the world. An essential element of innovation is the capacity of the business (and institutional) environment to seize opportunities to enter new market segments and possibly scale up. Firms in developing countries often do not operate at the technological frontier and imitation, technological upgrading and the increase of manufacturing capacities are therefore important areas of leverage for competitiveness and key elements in the process of catching up (Lee, 2005). Innovation by firms requires an enabling business environment.

With regard to perceptions of the innovation and business environment In Angola, over 50 per cent of survey respondents noted good opportunities to start a firm in the area in which they lived and believed they had the required skills and knowledge to start a business (figure 6). Since 2013, the share of positive answers has steadily increased. In 2020, over 75 per cent of respondents were confident about business opportunities and capabilities. The improvement in business conditions is also confirmed by the increasing share of respondents expecting their businesses to sustain a high rate of job creation in the next five years. However, the positive perception of the business environment is not reflected in the approach to innovation. The share of respondents indicating that their products or services were new to at least some customers and that few or no other businesses offered the same product was relatively low and did not show signs of improvement in 2014–2018. Innovation does not appear to be at the centre of entrepreneurial thinking, which may represent a significant constraint to the overall development of the business environment in Angola. Entrepreneurship should not be perceived as a goal but as a means to guarantee a lively business environment that can continuously innovate and create new growth opportunities.

Figure 6

Angola: Entrepreneurial behaviour and attitudes
(Percentage)

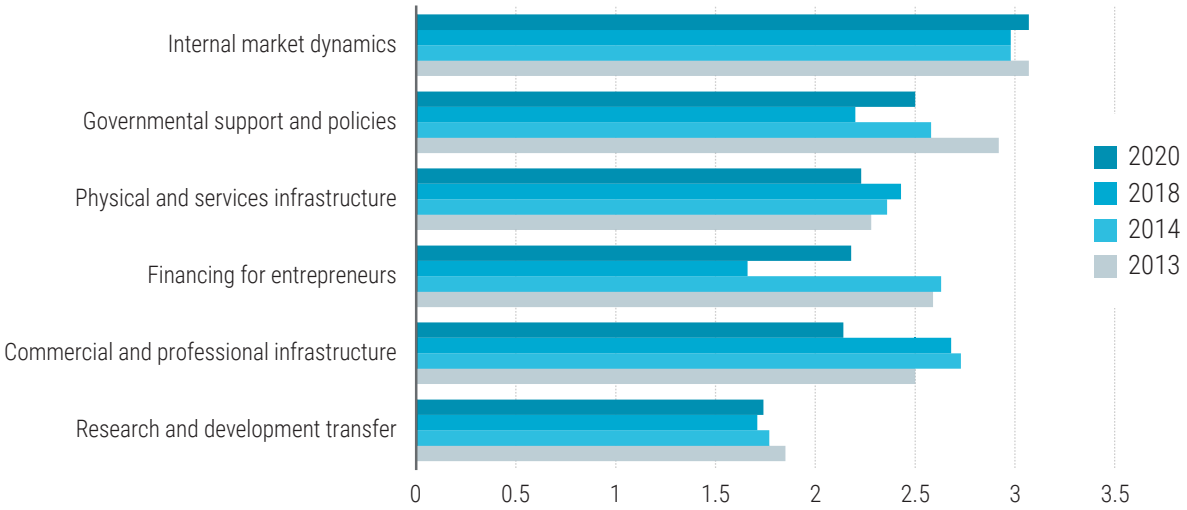


Source: UNCTAD calculations, based on data from the global entrepreneurship monitor.
Note: For 2020, innovation data are not available.

The perception of experts in different fields concerning government support and policies and financing for entrepreneurs decreased in 2013–2020 (figure 7). However, this negative performance is largely due to the decline in rating relative to during the reforms in 2018. After an initial period of lack of confidence, the general opinion improved in 2020. The indicator with the highest rating is related to internal market dynamics, which is in line with the perception of a good business environment. Commercial and professional infrastructure and financing for entrepreneurs seem to be areas in which improvements may be needed (the rating is lower than that for other indicators) and could be made (the rating is lower than in previous years). Among the areas considered, that with the lowest level of performance, and without an indication of improvement, is research and development transfer, namely, the extent to which national research and development leads to new commercial opportunities and is available to small and medium-sized enterprises.

Figure 7

Angola: Entrepreneurial framework conditions



Source: UNCTAD calculations, based on data from the global entrepreneurship monitor.
Note: The score ranges from 1 (highly insufficient) to 5 (highly sufficient).

With regard to innovation, the minimal data available may be indicative, yet provide the only information on enterprise innovation output in Angola. As part of the data-gathering process for *African Innovation Outlook 2019*, a survey was conducted of potentially innovative firms in Angola in 2013–2015 (African Union Development Agency-New Partnership for Africa's Development, 2019). Of 610 firms, a (non-random) sample of 141 firms were selected and, of these, only 41 provided responses. Of the responding firms, 35 stated that they had been innovating, with seven firms indicating that they had ongoing innovative activities and another seven stating that they had abandoned innovation activities during the period (table 6). Of the 21 firms that had successfully innovated, most had done so in the area of goods and services. Product innovation (goods or services) had allowed 18 firms to improve quality, 17 firms to increase their range of goods, 11 firms to increase their market share and seven firms to enter new markets. In addition, 25 firms were engaged in process innovation. All firms had engaged in organizational innovation, mainly by shifting work responsibilities, and most had performed marketing innovations. Six firms protected innovations through local patents and one had applied for an international patent; 17 firms used internal sources of information to innovate, 12 used suppliers and 11 used clients or customers; and, with regard to innovation processes, four firms used knowledge generated at government laboratories and one used knowledge generated at a university.

Table 6
Angola: Types of innovation used by firms

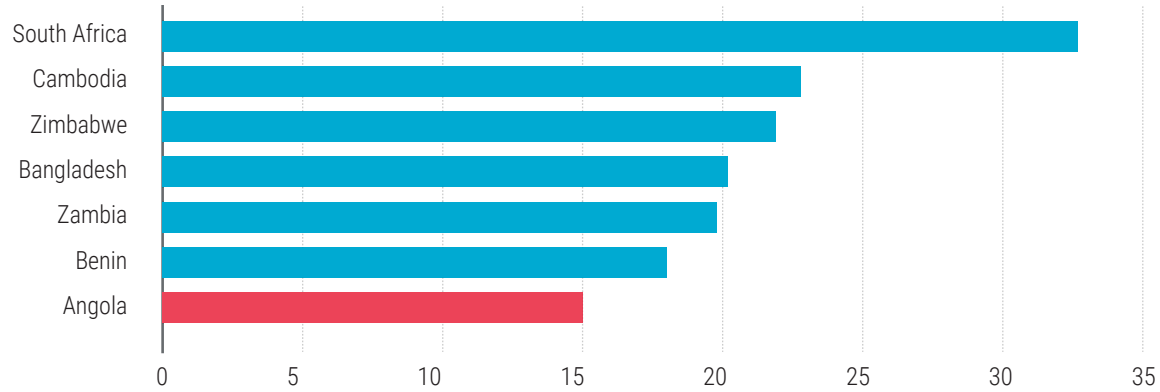
Type of innovation	Number of firms
New products	21
New goods	16
New services	15
Process innovators or innovative firms	25
Organizational innovation	
Business practices	17
Work responsibilities	21
External relations	13
Marketing innovation	
Significant design changes	13
New media or techniques	16
New methods for product placement	16
New methods for pricing goods	16

Source: African Union Development Agency-New Partnership for Africa's Development, 2019.

2.2 An emerging national innovation system

The innovation system in Angola is still at an early stage. For example, Angola was ranked 132 of 132 countries in *Global Innovation Index 2021*; the last time Angola entered the ranking was in 2015 (World Intellectual Property Organization, 2021). Inclusion in this ranking is largely due to the level of availability of data on the state of the innovation system. Data unavailability, or fragmented and non-systematic data collection, may signal a weakness in monitoring the evolution of a national innovation system and evaluating targeted interventions in particular areas of need. Inclusion in the ranking allows for comparisons of the overall strength of the innovation system in Angola with that in other countries in Africa and Asia; the system in Angola is relatively weak not only in comparison with that in South Africa, which ranks 61 globally, but also with those in other least developed countries (figure 8). In addition, the sophistication and development of the national innovation system are below expectations with regard to income per capita. Angola is ranked below the average of the group of lower middle-income countries and is near the lowest ranking in several areas. Interpretations need to take into consideration the fact that the index combines innovation inputs and outputs.

Figure 8
Global innovation index, various economies, 2021



Source: UNCTAD calculations, based on World Intellectual Property Organization, 2021.
Note: For comparison purposes, in 2021, the country with the highest index was Switzerland, at 65.5.

Close consideration of the components of the global innovation index clarify the areas of an innovation system in which Angola shows weaknesses in performance, namely, six main areas that include the creation and strengthening of local human capital, the creation of knowledge, linkages between public and private organizations, the state of the markets, the infrastructure supporting economic development and the institutional framework (table 7). Angola shows weaknesses in the creation of graduates in science, technology, engineering and mathematics and in overall research and development expenditure, which are reflected in unsatisfactory performances with regard to knowledge production (patents and articles). Angola has low levels of productivity growth and product complexity, reflecting the specialization of the country in primary products (mainly oil), the marginal contribution of the manufacturing sector in the creation of value added and a low level of industry diversification. In addition, the system of basic and applied research is not yet fully developed, linkages between industry and academia are weak and industrial and technological clusters are not yet operating efficiently; these weaknesses contribute to making the country not attractive for FDI (at least outside the oil sector). The low level of imports of high-technology products can be a cause or an effect of the lack of a developed industrial base but, in either case, may be seen as undermining an innovation strategy based on imitative innovation, the upgrading of existing industries and diversification into sectors that require similar productive capacities as those available in the economy.

Table 7

Angola: National innovation system indicators with performance below expectations compared with countries at a similar stage of development

Human capital and research	Knowledge creation, impact and diffusion	Innovation linkages and knowledge absorption	Market and business sophistication	Infrastructure	Institutions
Pupil to teacher ratio, secondary Number of graduates in science and engineering Gross expenditure on research and development Global corporate research and development investors Quacquarelli Symonds university ranking	Patents and scientific articles Share of high-technology manufacturing Labour productivity growth Production and export complexity	University and industry research and development collaboration State of cluster development and depth: High-technology imports Foreign direct investment net inflows	Ease of getting credit Ease of protecting minority investors Domestic industry diversification	ICT access ICT use Logistics performance	Government effectiveness Rule of law Ease of resolving insolvency

Source: UNCTAD calculations, based on World Intellectual Property Organization, 2021.

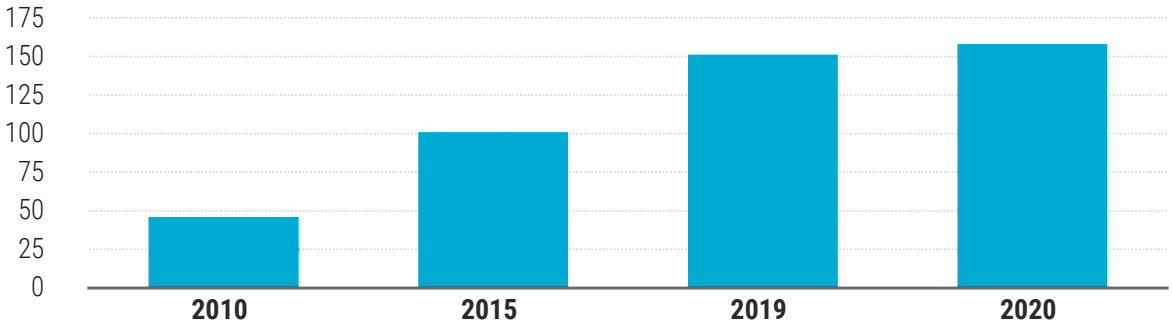
2.3 Scientific production

The number of scientific publications in peer-reviewed scientific journals has increased threefold in the last decade, suggesting an improvement in national scientific capabilities (figure 9). The

increase in publications has occurred in areas of knowledge similar to those in which Angola was active in 2010, suggesting the strengthening and related diversification of previous capabilities. The Ministry of Higher Education, Science, Technology and Innovation issued, in 2018, a statute on higher education teaching careers and, in 2020, a regulation for teacher evaluation, which both require the publication of papers. However, many researchers and professors are not familiar with this process, particularly in provinces with a low share of these professionals with master's or PhD degrees.

Figure 9

Angola: Scientific publications



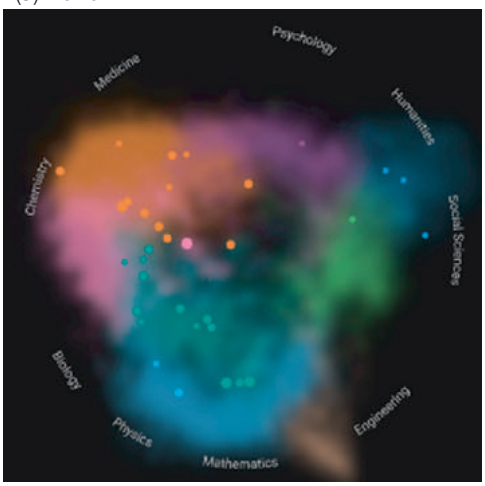
Source: UNCTAD calculations, based on data from the Scimago Journal and Country Rank.

A representation of basic research capabilities in Angola, proxied by publications in international peer-reviewed journals, is provided in figure 10, which shows the increase in scientific publications in 2010–2020 and three clusters of more active research, namely, areas at the boundary between medicine, chemistry and biology, in which publications are also in journals with the greatest impact; areas of biological (and agricultural) sciences; and areas at the boundary between biology and physics, including environmental and earth sciences. The relative weakness in areas related to engineering (and computer science) and, in particular, psychology and the humanities may be noted.

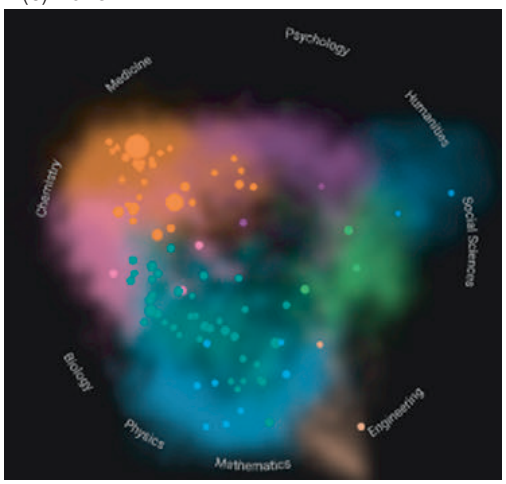
Figure 10

Angola: Bibliometric map of science

(a) **2010**



(b) **2019**



Source: Scimago.
Note: Similarity of colour shows the interconnections of different subject areas, derived from the relative position of peer-reviewed journals at the global level. The bubbles represent articles with authors from Angola and sizes are proportional to the impact of the journals in which articles are published. Journal impact is measured by the indicator on scientific journal rankings, representing the average number of citations received in a given year by articles published in the three previous years; the average is normalized by the number of references in the citing journal.

Despite the recent increase in publications, the contribution of Angola to global knowledge remains minimal. According to data from Scimago, in 2020, Angola was ranked 158 in scientific publications by country and had moved from 35 to 38 in the ranking of countries in Africa (after Guinea and before Burundi). Angolan-authored publications represent around 0.11 per cent of total scientific publications from Africa; Angola represents 2 per cent of the population of the continent.

2.4 Research and development

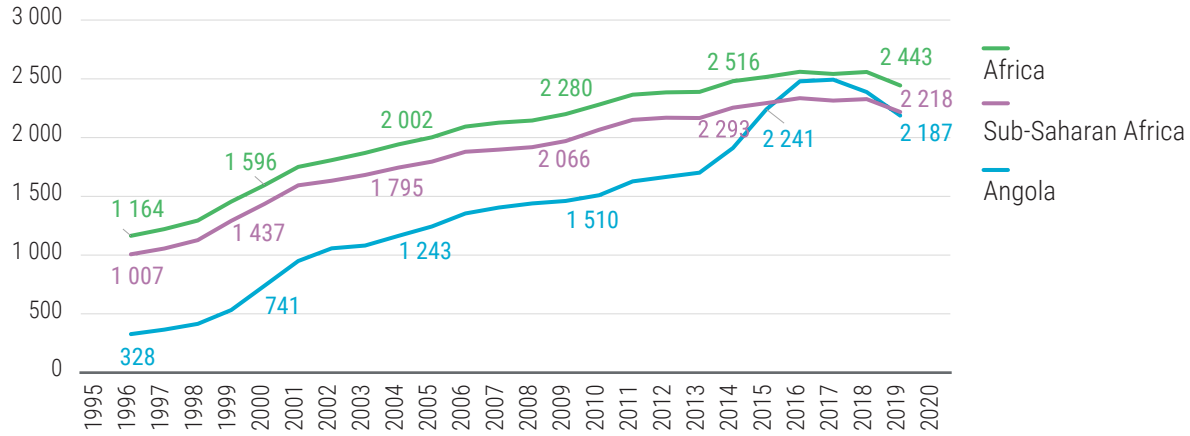
In 2016, research and development expenditure in Angola was 0.032 per cent of GDP, lower than the average of 0.49 per cent among lower middle-income countries and, among countries in Africa, higher only than expenditure in Madagascar. There is minimal information about research and development in Angola. Available figures are dated and it is therefore difficult to discern expenditure on technological change and innovation; the latest available figures are for 2016 and do not include expenditure by private or non-profit sectors. Based on information from the Ministry of Higher Education, Science, Technology and Innovation, current levels of research and development expenditure have not changed much in recent years. The voluntary national review on the Sustainable Development Goals shows that low levels of research and development have resulted in few patents, although the number of patents granted locally is growing (Government of Angola, 2021). In 2019, Angola filed 117 patents internationally and obtained 23; in 2020, 82 patents were filed and 25 obtained and in 2021, 30 patents were filed and 25 obtained (Government of Angola, 2021). However, patents are not the best indicator of a low-income economy, since much innovative performance is "under the radar", through efforts within firms and in the informal sector, which are often not recorded in statistics.

2.5 Economic diversification and complexity

Economic diversification is ultimately the result of innovation. In the past decades, Angola has been able to slightly diversify the economy (figure 11). In 1996–2013, the diversification of the economy, that is, the number of categories covered by exported goods, matched the increasing diversification registered in Africa and sub-Saharan Africa. However, increased diversification in terms of exported products has not been matched by a decrease in the concentration of exports in a few product categories that dominate the economy. Economic diversification in Angola accelerated in 2013–2016, when it increased at a fast pace, surpassing the average diversification in sub-Saharan Africa and reaching the average value registered for countries in Africa. However, since 2017, economic diversification has moved on a downward trend, with a decreasing number of different product categories within the export basket.

Figure 11

Export diversification (Number of categories of products)



Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: Figures are three-year averages.

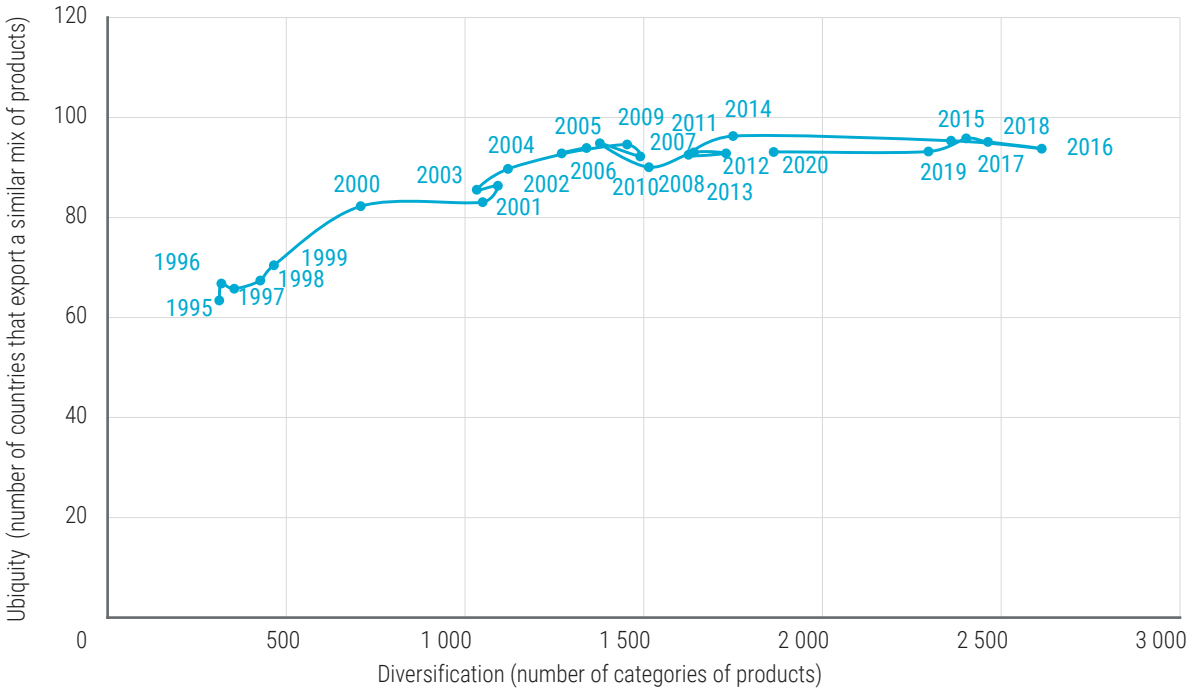
In general, economies that are more diversified tend to face a lower average level of competition. The reason is that more diversified countries tend to include in export baskets less ubiquitous products, meaning that they tend to add to the production basket goods not produced by many other countries. The positive association between diversification and ubiquity (the average number of countries exporting a similar mix of products) is because countries with greater knowledge and production capabilities are able to diversify into a broader set of products, including those requiring a greater set of interrelated capabilities to be produced and mastered by fewer countries (less ubiquitous).

The two measures of diversification and ubiquity can be combined to generate a measure of complexity of the economy reflecting the technological capacity used in production. Studies show that the production structure in developed economies presents high degrees of complexity, including a wide range of products of both low and high degrees of complexity, while production in less developed economies is often limited to products of low degrees of complexity (Economic and Social Commission for Asia and the Pacific, 2012). Other studies show that the major exporters of more complex products are high-income countries, that the major exporters of less complex products are low-income countries and that, in addition, export shares of more complex products increase with income (Felipe et al., 2012).

The evolution of product ubiquity in Angola is not following the expected pattern. In the period 1995–2020, a comparison of diversification with average ubiquity shows that Angola experienced an increase in both diversification and ubiquity prior to the global financial crisis of 2008/09 and that ubiquity has since remained substantially stable, with diversification increasing up to 2016 then receding (figure 12). In other words, the diversification of the economy was obtained through the addition of products produced by a greater number of countries (increasing ubiquity). The positive association between diversification and ubiquity should be taken as a warning: the economy has diversified into products requiring a lower level of knowledge content, reducing competitiveness and potential growth. A possible phenomenon related to this positive association is that Angola is not diversifying as fast as other countries and that the new products added are already produced by an increasing number of countries.

Figure 12

Angola: Diversification and ubiquity of exports



Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.

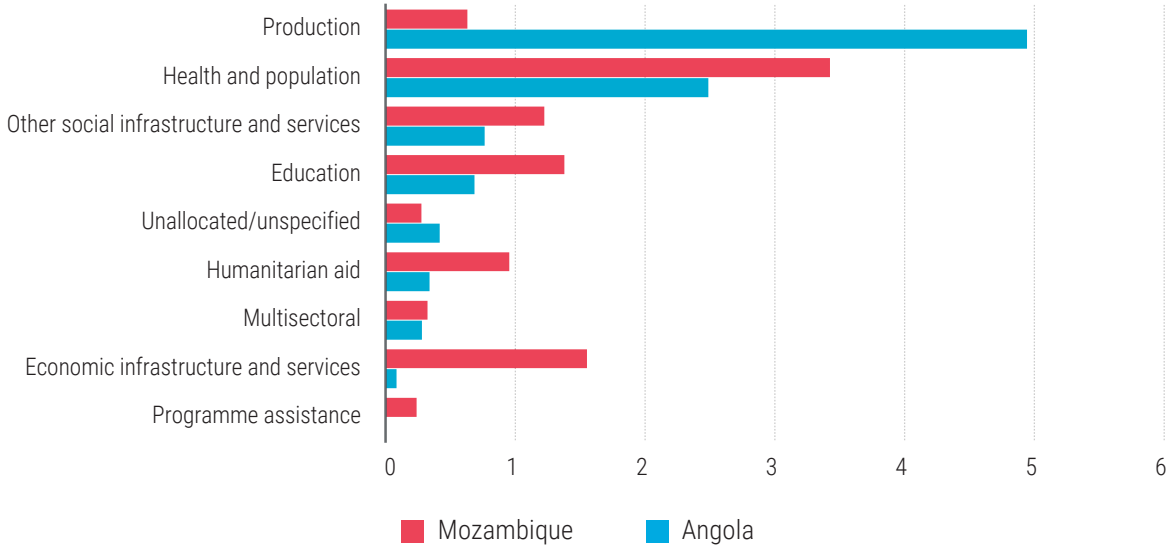
2.6 *International support*

Among the targets under Goal 9, one is related to international support; target 9.a is to facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to countries in Africa, the least developed countries, landlocked developing countries and small island developing States. The indicator used to measure achievements towards this target is total official international support (official development assistance plus other official flows) to infrastructure. In Angola, the share of official development assistance directed towards the development of infrastructure appears low, as shown in a comparison of the distribution of such assistance in Angola and Mozambique (figure 13). In Angola, almost half of bilateral official development assistance is directed towards production, a higher share than that of Mozambique or the 10 per cent average of Africa. The share of official development assistance directed to the support of social infrastructure and services is lower than that in Mozambique and the share of official development assistance directed towards the support of economic infrastructure and services is only about 2 per cent.

Figure 13

Angola and Mozambique: Bilateral official development assistance by sector, 2018–2019 average

(Percentage)



Source: UNCTAD calculations, based on data from Organisation for Economic Co-operation and Development, 2022.

The distribution of official development assistance does not appear to match the objective in the 2030 Agenda for Sustainable Development of supporting the development of hard and soft infrastructure in the least developed countries. The lack of well-developed hard (power, roads) and soft (financial, legal) infrastructure determines transaction costs for the economy that do not allow for the efficient allocation of resources. The continuous improvement of hard and soft infrastructure to reduce transaction costs is needed in the transition towards a modern industry based on the creation of new competitive advantages.

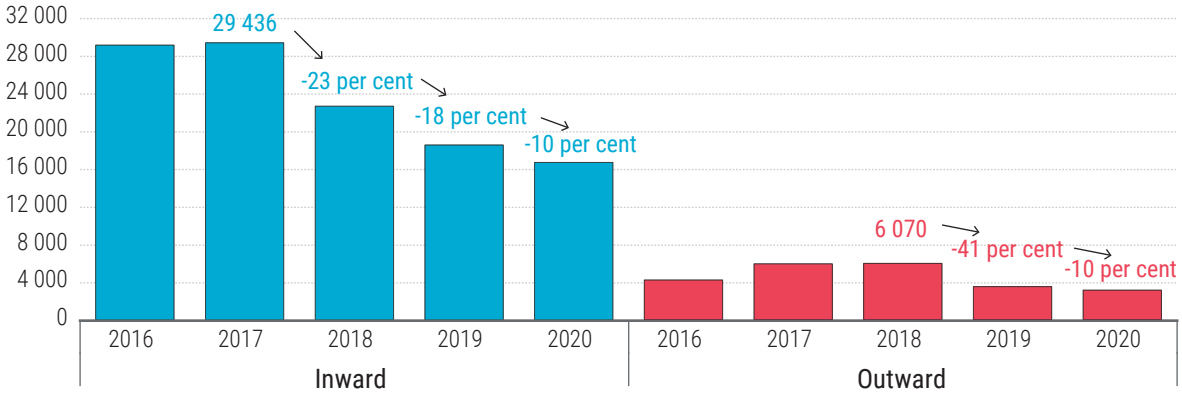
However, the distribution of official development assistance should be considered together with the relative relevance to the receiving economy. In Angola, official development assistance has decreased substantially in recent years, from $372 million in 2003 to about $50 million in 2019. In 2019, official development assistance to Mozambique was about $1.1 billion and to Cameroon, about $682 million.

FDI represents another important source of external finance, received from private entities. Such inflows are largely motivated by the long-term prospects of investors in earning profits in production activities they control directly. FDI may promote economic growth by creating jobs and business opportunities and through the accumulation of capital in the receiving country. FDI has generally been recognized to positively affect economic growth in the receiving country. However, the impact of FDI largely depends on a country's capacity to take advantage of the productivity spillovers associated with FDI activities. If there is a low level of ability to absorb technology, as in many developing countries, a wide technology-related gap between domestic and foreign economies may eventually result in negative impacts on economic growth. By contrast, the interaction of FDI with human capital exerts a strong positive effect on economic growth in developing countries (Li and Liu, 2005).

In Angola, in 2016–2020, FDI registered a downward trend (figure 14). In 2017, the stock of FDI inflows was about $30 billion. The repatriation of capital by foreign multinational enterprises in the oil and gas sector was significant in 2017 and 2018 (about -$7.4 billion and -$6.5 billion), then slowed in 2019 and 2020 (UNCTAD, 2021a). Overall, the decrease in the stock of FDI was particularly significant in 2016–2020, at -43 per cent. However, some large deals announced in 2020 signal the engagement of foreign investors. Large projects in non-renewable energy have been initiated by companies in Italy, with an investment of $1.3 billion for a natural gas processing plant, and the United Kingdom of Great Britain and Northern Ireland, with an investment of $920 million for a petroleum refinery project (UNCTAD, 2021a). In 2019, the decrease in the stock of outward FDI from Angola was significant, at -41 per cent.

Figure 14

Angola: Inward and outward foreign direct investment stocks
(Millions of dollars)

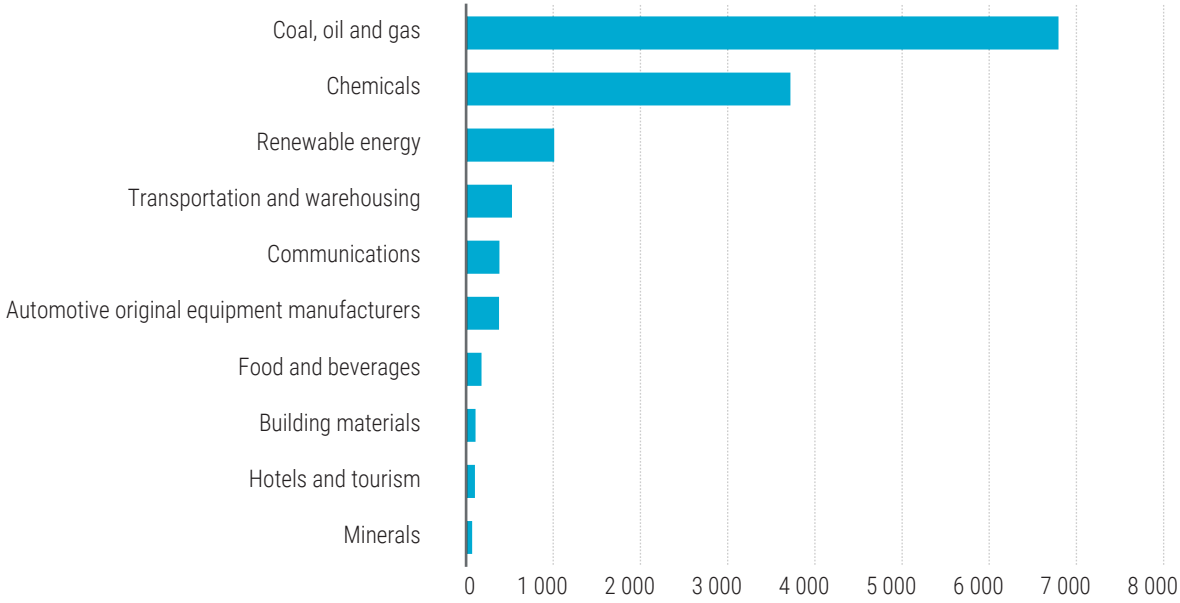


Source: UNCTAD, 2021a.

With regard to greenfield FDI, in Angola, in 2017–2020, there was a high level of concentration of FDI inflows in a few sectors (figure 15). About 87 per cent of overall FDI is concentrated in the following three sectors: coal, oil and gas, at 51 per cent; chemicals, at 28 per cent; and renewable energy, at 8 per cent. Angola has the capacity to attract sizeable foreign investment only in those sectors in which production is already highly concentrated; the low level of attractiveness of other parts of the economy to foreign capital may constitute a further constraint to triggering a process of sustained economic growth.

Figure 15

Angola: Greenfield foreign direct investment inflows by destination sector, 2017–2021 (Millions of current dollars)



Source: UNCTAD calculations, based on data from the *Financial Times* FDI markets database.

2.7 Measuring and monitoring progress

A significant limitation to an analysis of the national innovation system is the absence of current STI-related data and the dated nature of available data. Data on basic STI-related indicators such as research and development expenditure are from 2016 and only cover the Government and higher education. Neither data on private research and development expenditure nor on private researchers are available. As noted in *African Innovation Outlook 2019,* in Angola, there is no tradition in the private sector of contributing information on operations, yet some countries in Africa have such information available through censuses or special purpose surveys (African Union Development Agency-New Partnership for Africa's Development, 2019).

The situation is similar with regard to other indicators. The global innovation index shows that Angola does not have or does not provide human capital, market, business, knowledge and creative output indicators (World Intellectual Property Organization, 2021). Human capital indicators that are missing or outdated include government funding per pupil, Programme for International Student Assessment test results and tertiary inbound mobility; market indicators that are outdated include data on market capitalization and venture capital; business sophistication indicators that are missing include data on private research and development, research and development financing and the value of partnerships and patents. Data availability and reporting are not only deficient but also inconsistent. Angola did not report to the global entrepreneurship monitor in 2019; therefore, changes cannot be determined (Bosma et al., 2021). Output indicators are also lacking. For example, with regard to the global innovation index, knowledge indicators that are missing include the number of new businesses and figures on software expenditure; and creative output indicators that are missing include data on brand value, industrial design and the ICT and entertainment industries (World Intellectual Property Organization, 2021). The index was therefore prepared with only 45 of 81 valid indicators (table 8). In Angola, the only innovation survey openly available has reached only 41 firms. The Ministry of Higher Education, Science, Technology and Innovation made efforts to initiate a comprehensive third national survey on STI in 2015–2018, including the

appointment of a team and the distribution of questionnaires online, but further progress does not appear to have been made.

Table 8
Angola: Missing indicators under the global innovation index

Component	Missing	Outdated	Total	Total number of indicators
Institutions	–	–	n/a	7
Human capital and research	3	7	10	12
Infrastructure	–	–	n/a	10
Market sophistication	3	1	4	10
Business sophistication	4	5	9	15
Knowledge and technology outputs	2	3	5	14
Creative outputs	6	2	8	13
Total	18	18	36	81

Source: UNCTAD calculations, based on World Intellectual Property Organization, 2021.

Rigorous and scientific analysis and public policy require accurate data and statistics. They cannot be based on ideology, beliefs, common sense, anecdotes or intuition. Without accurate data, methods and analyses will be faulty and conclusions and recommendations biased or inaccurate. Policy evaluation and monitoring require solid evidence to be effective, give credibility to findings and convince others when changes are necessary. In addition, the ongoing data revolution means that big data will be at the centre of future STI and related policymaking.

The Government of Angola has recognized the need to improve data collection and statistics, noting that the "development of the VNR [voluntary national review] is an opportunity to reflect on the best ways to improve statistical information and data on development and thus develop strong and efficient systems on an ongoing basis" and that an inability to produce, compile and analyse data oriented explicitly to achieving the Sustainable Development Goals, as are most STI-related data and statistics, could be a factor in the success of this achievement (Government of Angola, 2021).

2.8 Way forward

Overall, there is much room for improvement in innovative performance in Angola. Some changes have been made with regard to corporate organization and marketing and a few firms are attempting to introduce new products and processes. Respect for intellectual property is high on the local innovation agenda and political stability, a large local market and attempts to improve aspects of the business environment are present, along with a certain level of efficiency in the transformation of inputs into outputs. However, to date, results have fallen short of expectations. Overall innovative performance scores are low and are among the lowest in sub-Saharan Africa and worldwide. There is little evidence of technological innovation or technological change. Many initiatives aimed at improving innovative performance are not achieving intended results. Finally, innovation is not yet contributing to national diversification and development goals as there is not yet a significant amount of innovation.

3. National innovation system

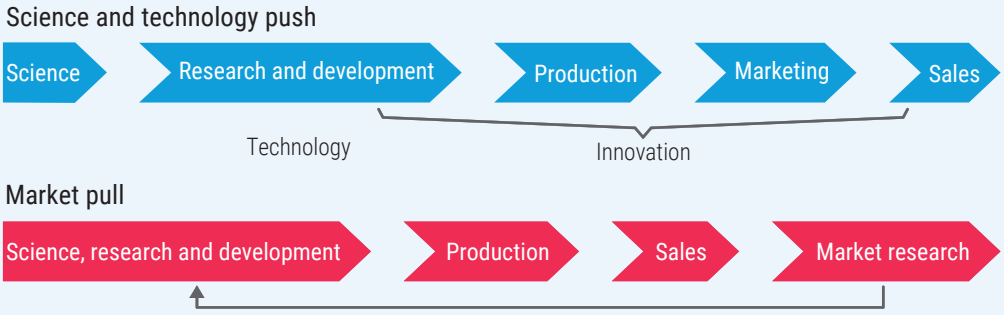
A national innovation system is a network of public and private institutions, organizations and actors whose activities and interactions within national borders lead to the production and dissemination of knowledge aimed at technological change and innovation (Freeman, 1987; Lundvall, 1992; Nelson, 1993). Such a system operates within national borders but is fed by contributions from beyond the border and inputs from local, sectoral and regional innovation subsystems (box 1). How the national innovation system functions within a country, as well as its competencies, incentives, governance and policy approaches, determine the rate and direction of technological change and the extent of innovation (Alcorta and Peres, 1998; Patel and Pavitt, 1994). The main role of a national innovation system is to convert knowledge into innovation. Knowledge is either embodied in machinery, equipment and components; or is disembodied and codified in books, formulas, blueprints, drawings and patents; or is tacit, involving intuitive, hard-to-define knowledge that is largely experience-based and disseminated and enlarged through human interaction. Innovation, the outcome of a national innovation system, is cumulative in that it results from the often slow and combined aggregation of the impacts of individuals, institutions, organizations, investments and public policies and their interactions (Lundvall, 1992).

Box 1

From linear innovation to national innovation systems

Investing mainly in science and some research and development, which should spur the development of applied technologies that will later become commercialized, is referred to as the linear model of innovation (see figure). Such practices could be observed, with some variety, in many developed countries until the 1960s. Linear innovation was sometimes described as a technology push model because it was assumed that markets and consumers were eager to embrace almost any innovation that could be generated. In the1970s, an alternative model was proposed that referred to market pull, a process that replaced scientific research with market research as the starting point for innovation, with sales information feeding back into market research.

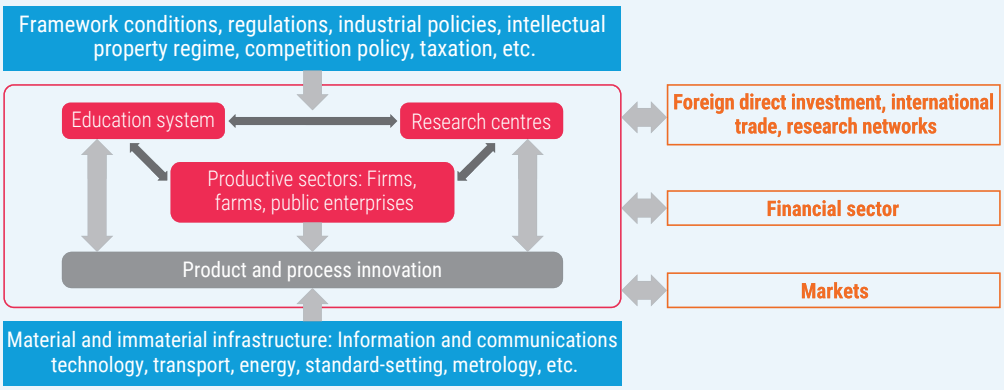
Linear innovation



However, innovation is not linear and involves processes that are complex, with many feedback loops of varying strength involving a greater scope of STI stakeholders than merely scientists and industrialists. A linear innovation mindset can often be observed among policymakers and STI stakeholders. The idea that improved funding for science and research and development is the solution to development challenges often translates into policies that are necessary but insufficient. The lack of capacity and capability among firms and institutions to absorb technology, together with microeconomic and macroeconomic disincentives, make spending alone ineffective. Without deliberate linkages to productive sectors in services and industry and policies that govern and support them, research outcomes vary in relevance and effectiveness.

The concept of a non-linear national innovation system results from the realization that innovation takes place mainly in firms and that firms do not innovate in isolation but interact with other firms and institutions and with the general public. Firms develop and exchange the knowledge and technologies needed to innovate in a particular environment. In increasingly competitive sectors and industries, learning becomes a permanent activity. The sum of firms' technological capabilities, interactions and knowledge flows, between firms and with institutions and people in a national environment, is referred to as a national innovation system (see figure).

National innovation system



Source: UNCTAD.

The national innovation system of Angola has made a significant leap forward in the past 20 years (box 2). Progress in scientific and technological output was slow in the late 1990s and 2000s due to the lack of capacity among the main actors, fragmented efforts and poor coordination and interlinkages. However, faced with these challenges, in the past decade, the Government has implemented several initiatives to foster an efficient national innovation system through a comprehensive and systemic approach to developing national STI capacities. There is still scope to fine-tune the system and foster an effective system that focuses on innovation and economic diversification, creating more and better-paid jobs and promoting economic structural transformation with greater equality and sustainable outcomes.

Box 2

Angola: Origin and evolution of the national innovation system

Following independence in 1975, and the period of civil war that ended in 2002, the national innovation system began to emerge in the late 1990s. The Ministry of Science and Technology was established in 1997 and was at the centre of the system, with STI advisory, planning, coordination, promotion, policy formulation and dissemination functions. In addition, a high board of science and technology was established, tasked with defining policies for scientific research and monitoring research progress. The emphasis was on scientific research and the diffusion of new technologies, with innovation support functions under other government bodies or not taken into account. The main policy instrument introduced by the Ministry of Science and Technology at the time related to attracting and retaining scientists in public research institutes.

Progress was slow in the first decade of the national innovation system. According to a study by the African Union in 2010, in 1990– 2009, scientific output from Angola amounted to 237 papers and the average in 2005–2009 increased to over 20 papers per year. Outputs were concentrated in medicine and immunology (46.8 per cent) and agriculture, biology and earth sciences (25.3 per cent). STI efforts placed Angola at 18 of 19 countries in Africa covered by the study. In 1993–2007, the United States Patent and Trademark Office did not grant any patents to Angola and in 2001–2005, granted only 0.01 patents per million inhabitants. This low level of scientific and technological output resulted from low levels of education; a disconnected university sector; low levels of overall research and development expenditure that depended on foreign aid; the poor absorption capacity of enterprises; a non-favourable business environment; and a decayed infrastructure. Other factors in the slow rate of progress were the lack of clear guidelines and priorities; the dispersal and fragmentation of resources, initiatives and efforts; the absence of articulation between actors; and limited funding.

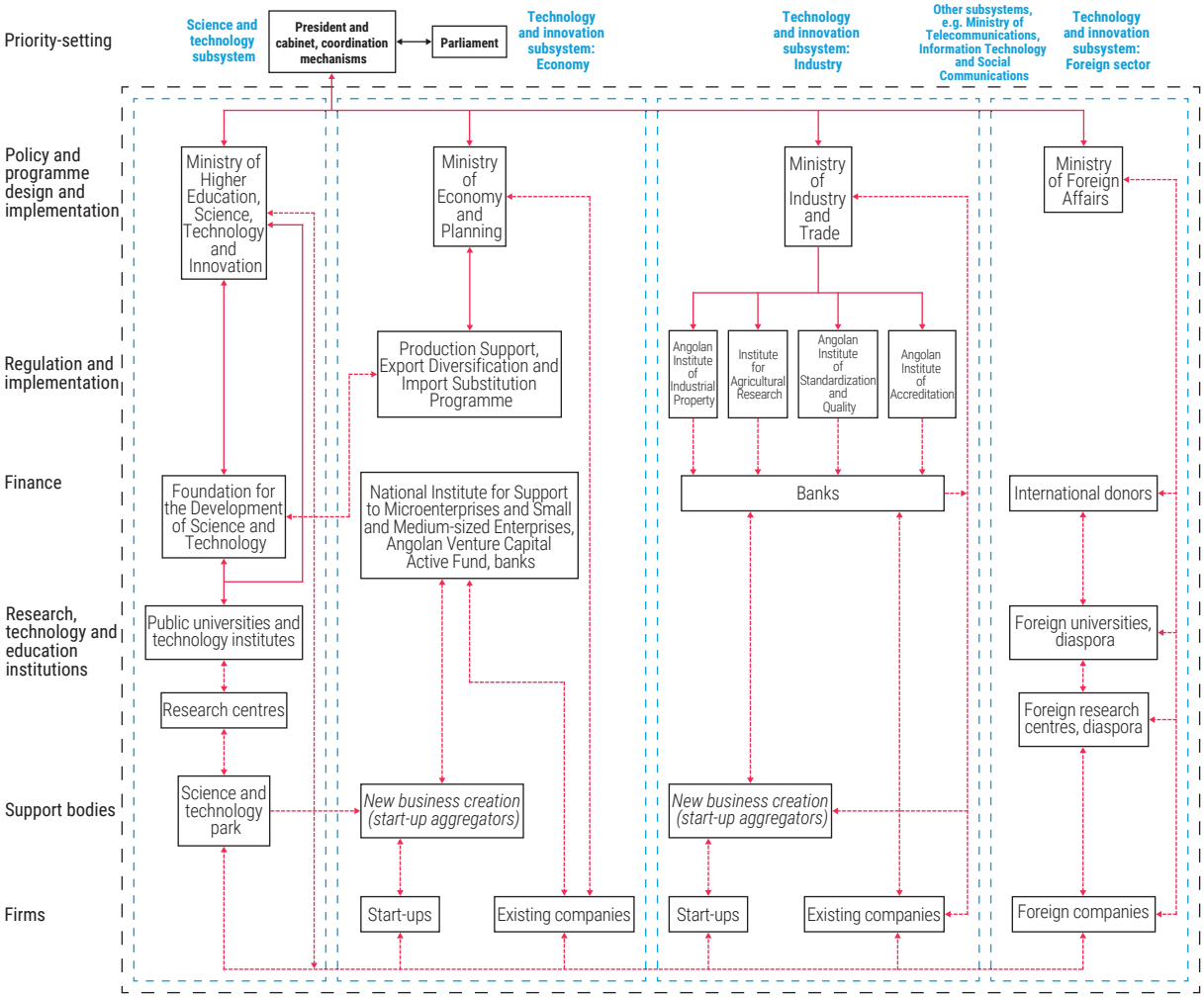
The Government of Angola made efforts to overcome these challenges. In 2005, following a meeting of ministers in Africa in charge of science and technology and the introduction of the African Innovation Outlook publication aimed at monitoring and evaluating developments in the STI field in the region, the Government of Angola invited UNCTAD to assess the national innovation system. UNCTAD, as detailed in the STI policy review in 2008, found that while capacity-building was taking place in several key areas, the Government had yet to shift from post-conflict reconstruction to a national development approach. UNCTAD recommended that the Government should make adequate institutional arrangements to ensure the centrality of STI in the development process. Four areas of STI needed to be strengthened, namely, education and learning, research and development capacity, financing and STI-related policies and measures. Efforts in these areas needed to be complemented by an industrial policy to promote technological learning at the enterprise level; revitalized agriculture-related research and development, to ensure food security and diversify exports; and the defragmentation of the health system, to generate synergies across programmes. UNCTAD also noted that the Ministry of Science and Technology was particularly well placed to lead these initiatives yet its role with regard to ministries responsible for other sectors needed to be clearly defined; additional emphasis on education in engineering and sciences was necessary; more proactive STI policies needed to be put in place; and a knowledge culture needed to be fostered. Finally, UNCTAD noted that separating science and technology policy from innovation policy could reduce the success of both, while a coordinated approach could be mutually reinforcing.

Source: African Union Development Agency-New Partnership for Africa's Development, 2010; Liberato, 2021; UNCTAD, 2008.

Innovation requires the work of all subsystems of the national innovation system of Angola (figure 16). The science and technology subsystem feeds scientific knowledge into the system; scientific knowledge is based on evidence and included in scientific theories and many innovations find their origins in scientific knowledge, yet the knowledge is only commercially valuable in society once it has been converted into products or services, and such a conversion can take place only if the other subsystems are involved. The economy subsystem provides financial and managerial support through the Production Support, Export Diversification and Import Substitution Programme and related agencies. The industrial subsystem provides for applied technical solutions, protection for innovators (Angolan Institute of Industrial Property), standards and quality control and certification. The foreign sector can provide scientific, technical and practical knowledge, as well as financial support. Knowledge generation is not limited to the ministries and agencies depicted but extends to all ministries, agencies and stakeholders within their respective domains. Different types of knowledge emerge in each subsystem and each can result in innovation, with more radical innovations closer to the domain of science and incremental innovations closer to the domain of industry. Through interaction and working together, knowledge can be accumulated, and there are synergistic features. Within a national innovation system, the better the interaction and linkages between stakeholders, the more successful the system becomes.

Figure 16

Angola: National innovation system, stylized representation



Source: UNCTAD.
Note: Arrows with dashed lines represent links to be strengthened.

The national innovation system of Angola needs to set priorities to operate effectively, which should be determined at the presidential level, with parliamentary involvement if required, following coordination with all relevant ministers and stakeholders. Effective coordination between stakeholders should be a driving force throughout the innovation process. Once priorities have been set, policies and programmes should be established to reach them, and should be focused and well thought out in order to succeed. Their design and some aspects of their implementation should be the responsibility of ministries or similar government bodies. Implementation that requires more specialized and technical knowledge, such as particular regulatory aspects, finance, research or business support, should be the responsibility of institutions or mechanisms with clearly defined functions. However, given their unique position in the national innovation system, it is firms that bring together all innovation inputs and convert them into new products and services and production processes.

Key features of the national innovation system of Angola are examined in this chapter, including the main organizations and actors and their relationships. Key strengths and weaknesses are identified and suggestions for improvement are provided. The main actors are the public sector, private firms, education and research institutes and finance organizations. Finally, the question is addressed of whether the national innovation system is fit to address the STI challenges faced by Angola and support the aim of achieving the Sustainable Development Goals.

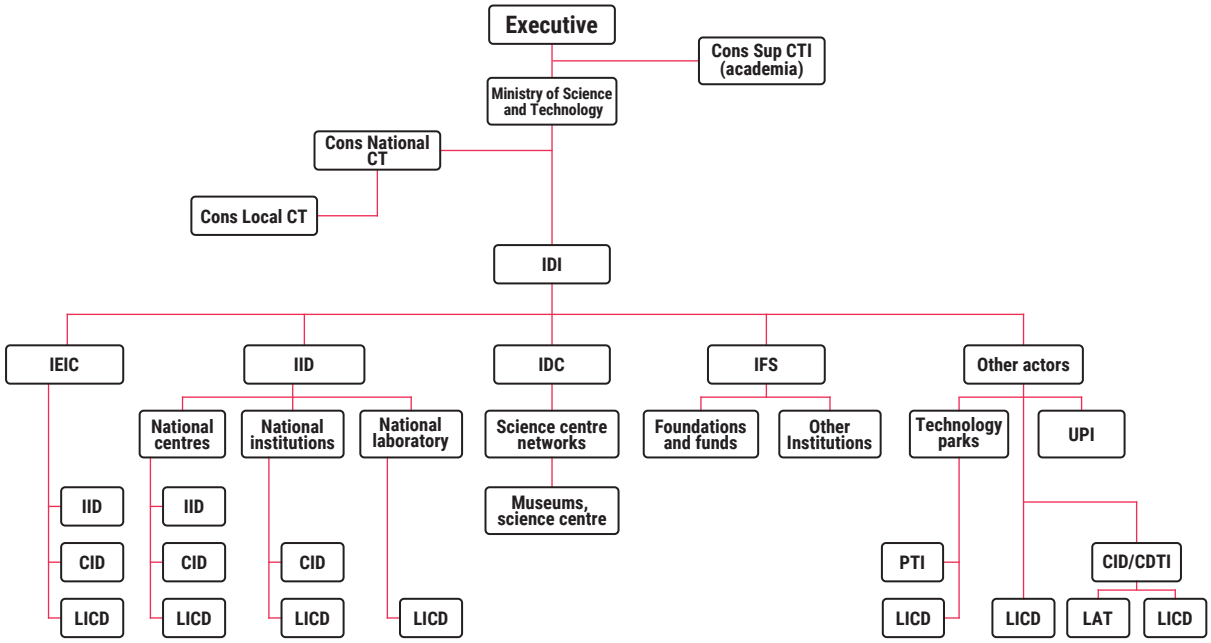
3.1 Science, technology and innovation framework

In the past decade, Angola has implemented one of the swiftest and most ambitious attempts at establishing a national innovation system in the African region. In 2011, the Government passed laws introducing the national STI strategy 2011–2016 (Presidential Decree 196/11 of 11 July 2011), the national STI policy (Presidential Decree 201/11 of 20 July 2011) and the coordinating mechanism of the national system of STI (Presidential Decree 224/11 of 20 August 2011). With regard to the national STI policy, goals are identified under the following three main pillars: organization and development of the national STI system; contribution of STI to sustainable development in Angola; and funding of the national STI system. The policy prioritizes several areas, including higher education and professional training; agriculture and fisheries; ICT; industry, oil, gas and mineral resources; health; water resources; energy; and the environment. The national STI strategy establishes ways and means of attaining the objectives of the Government in the short and medium terms, following the vision and mission in the policy. The coordinating mechanism introduces coordination and supervision mechanisms to improve the interactions between different agencies and organizations expected to form part of a fully operative national innovation system.

These laws were followed by additional legislation to establish and strengthen STI institutions, involving the creation of the National Centre for Scientific Research and the National Technological Centre; the establishment of a broad network of diverse scientific research, technological development and innovation institutes; and the revamping of the Angolan Institute of Industrial Property. The Government also established the High Council for STI; the National Science Council; and scientific councils connected with other scientific research, technological development and innovation institutes (Presidential Decree 321/14 of 1 December 2014). Many of these institutes were part of the growing number of public and private universities being established in parallel. STI plans for 2013 and 2014–2015 were also introduced, including budgeted STI programmes and projects linked to goals and targets (figure 17).

Figure 17

Angola: Science, technology and innovation subsystem organizational chart, 2016



Abbreviations: CDTI, centres for technological development and innovation; CID, centres for research and development; IDC, science dissemination institutions; IDI, public institutions for scientific research, technological development and innovation; IEIC, teaching and scientific research institutions; IFS, national STI system financing institutions; IID, scientific research and development institutions; LAT, technical support laboratory; LICD, scientific research and development laboratory; PTI, technology and innovation poles; UPI, private investigation units. *Source*: UNCTAD.

The results of this significant legislative, planning-related, administrative and investment-related effort was the creation of many of the components of the national innovation system. With regard to human capital formation, new master's and PhD programmes were introduced in agriculture, biology, business administration, chemistry, education, the environment, information technology engineering, law, medicine and social sciences. Improvements were made in the quality of education through teacher training, including upgrading English language and statistical software skills. Research was boosted through the rationalization and upgrading of library services and the provision of better access to information. Information-sharing increased due to the creation of an online science portal for STI and specialized scientific magazines. Research projects were begun, often in the fields in which the new master's and PhD programmes had been established. The annual Conference on Science and Technology, showcasing local developments in all fields of knowledge, was established. The research infrastructure was enhanced by establishing new research centres, laboratories, technological centres and poles and technology transfer initiatives. The National Centre for Scientific Research and the National Technology Centre were expanded and some entrepreneurship initiatives were associated with the latter. Finally, scientific advisory councils at all levels of STI governance proliferated nationwide.

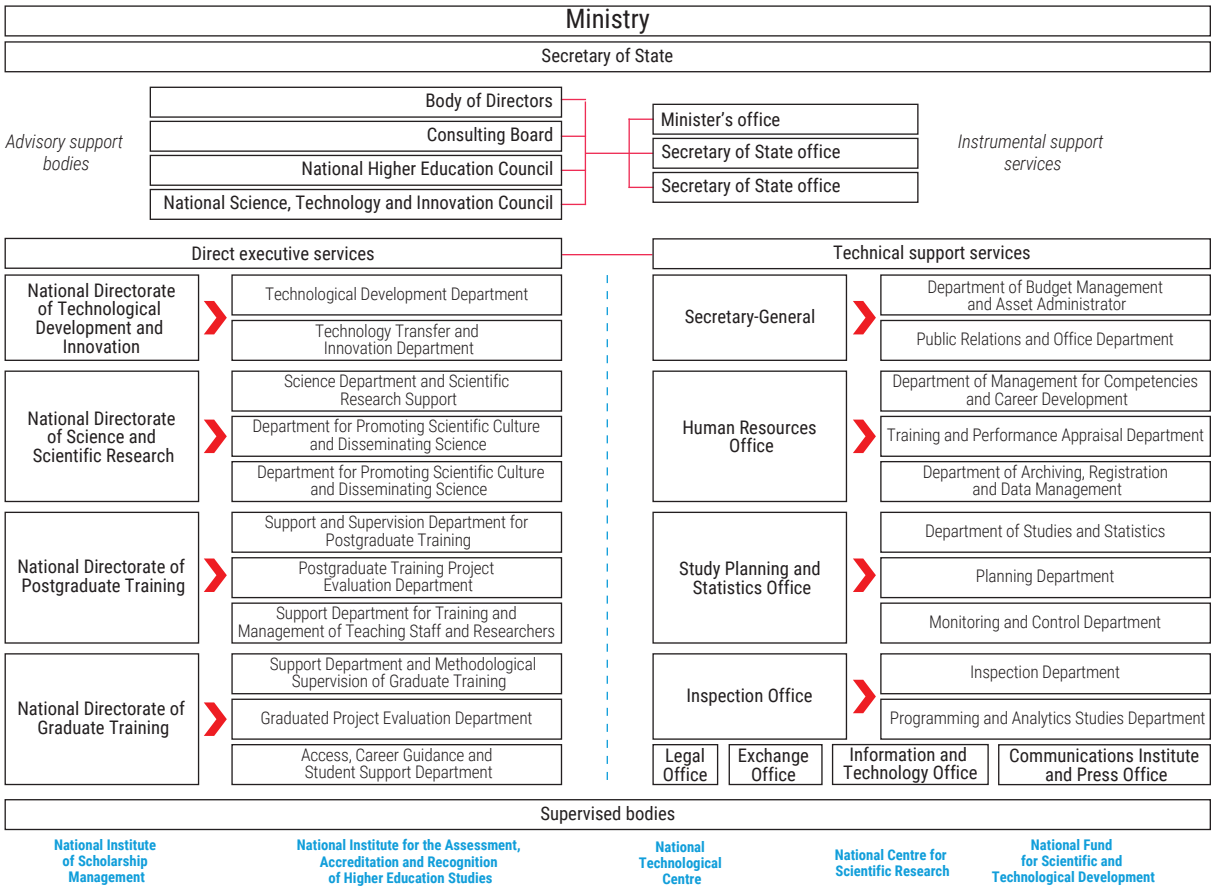
Since 2018, national innovation system institutions and organizations have experienced significant changes. As part of the Government drive to streamline the public sector, ministries and public institutions have been merged and rationalized, a process accompanied by the privatization of public enterprises and the sale of State holdings. At the apex of the national innovation system, the Ministry of Science and Technology was merged with the Ministry of Higher Education. The Ministry of Economy and Planning is also part of the national innovation system, including such

functions as promoting national development, particularly diversification, and coordinating the implementation of policies supporting innovation and national competitiveness. The National Directorate for Economy, Competitiveness and Innovation focuses on innovation policies and programmes. The Ministry of Economy and Planning is responsible for the Production Support, Export Diversification and Import Substitution Programme (PRODESI), aimed at accelerating the diversification of the national economy by supporting production and exports in non-oil sectors and sectors with a strong potential for import substitution and promoting innovation and technological change, thereby enhancing economic growth. The functions of the Ministry of Higher Education, Science, Technology and Innovation include the following (figure 18):

- Plan, organize, regulate, supervise, evaluate, partner internationally and procure funding for the development and modernization of higher education and research and technological centres and personnel
- Promote equal access to higher education, propose and run a scholarship mechanism, propose educational courses and programmes, ensure academic calendars and obligations are followed and certify degrees domestically and internationally
- Coordinate higher education and STI activities with national development objectives and the productive sector, support the creation and expansion of higher education and research networks and disseminate the knowledge generated by the higher education system into local and global agendas

Figure 18

Angola: Ministry of Higher Education, Science, Technology and Innovation organizational chart

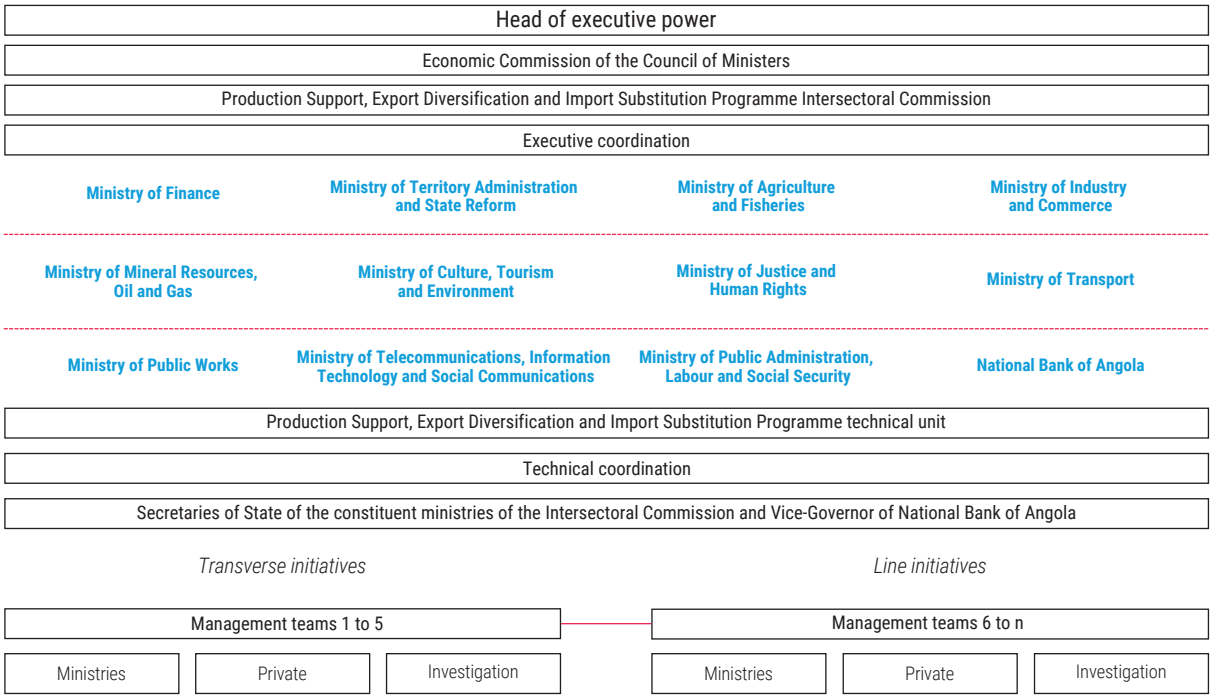


Source: UNCTAD.

The Production Support, Export Diversification and Import Substitution Programme has a cross-cutting interministerial coordination approach with various initiatives, subprogrammes, projects and activities (figure 19). The Intersectoral Commission has several features aimed at achieving proper coordination. It is a high-level team, that is, it is headed by the Ministry of Economy and Planning, one of the most senior ministries, with budget-allocating power over other ministries. The Commission reports to the economic council of the Cabinet, headed by the President, giving it significant political power. The organization of the Commission is along matrix lines, combining sectoral and cross-cutting initiatives and thereby allowing for interaction between diverse objectives and perspectives. The Commission is backed by a technical unit formed by the secretaries of state in the constituent ministries of the Commission and by the Vice-Governor of the National Bank of Angola, thereby giving it operational strength. The Production Support, Export Diversification and Import Substitution Programme has a communications strategy to disseminate results.

Figure 19

Angola: Production Support, Export Diversification and Import Substitution Programme governance mechanism



Source: UNCTAD.

At the operational level, the current institutional structure of the national innovation system is based on cross-cutting sectors and sectoral activities, with each ministry overseeing several institutions (table 9). The Ministry of Higher Education, Science, Technology and Innovation is responsible for institutes of higher education, which includes all public universities and 14 private institutes of higher education, as well as the following five institutes of scientific research, technological development and innovation: National Fund for Scientific and Technological Development; National Institute for Evaluation and Accreditation of Higher Education Institutions; National Institute for Scholarships; National Scientific Research Centre; and National Technological Centre. The Ministry of Agriculture and Fisheries is responsible for the following technological development and innovation centres: Forest Development Institute; Institute for Agricultural Research; and National Institute for Fisheries Research. The Ministry of Industry and Commerce is responsible for the following: Angolan Institute of Accreditation; Angolan Institute of Industrial Property; Angolan Institute of Standardization and Quality; Angolan Institute of Industrial Development and National Institute for

Industrial Innovation and Technologies (the latter two are going through a merger process). Other ministries are responsible for public research efforts in their respective sectors. Ministries regulate and provide policy guidance and institutes, to differing degrees, conduct research and execute technology-related projects.

Table 9

Angola: Institutes of scientific research, technological development and innovation

Angolan Institute of Accreditation	Institute for the Development of Artisanal Fisheries and Communal Aquaculture	National Institute for Industrial Innovation and Technologies
Angolan Institute of Industrial Development	Institute for the Fight and Control of Trypanosomiasis	National Institute for Meteorology and Geophysics
Angolan Institute of Industrial Property	Institute for Veterinary Research	National Institute for Public Health
Angolan Institute of Standardization and Quality	National Archives of Angola	National Institute for Research and Development in Education
Atomic Energy Regulatory Authority	National Centre for Scientific Research	National Institute for Scholarships
Digital Technology Centre	National Fund for Scientific and Technological Development	National Institute for Support to Fisheries Industries and Technological Research
Engineering Laboratory of Angola	National Institute for Cereals	National Institute for Support to Microenterprises and Small and Medium-sized Enterprises
Forest Development Institute	National Institute for Coffee	National Museum of Anthropology
Geographic and Cadastral Institute of Angola	National Institute for Cultural Heritage	National Museum of Natural History
Geological Institute of Angola	National Institute for Employment and Vocational Training	National Quality Control Laboratory
Institute for Agricultural Research	National Institute for Evaluation and Accreditation of Higher Education Institutions	National Technological Centre
Institute for State Equity Management	National Institute for Fisheries Research	Sub-Saharan Africa High-Technology Centre

Source: UNCTAD.

Consolidation is taking place among public research institutes and technological centres. The National Scientific Research Centre and the National Technological Centre are being merged into a single organization and many research centres are being rationalized at universities, brought directly under or incorporated into departments and faculties and made subject to direct ministry supervision. Consolidation within universities is expected to close some scientific research centres. To guarantee that management improves the quality of scientific research, the Ministry of Higher Education, Science, Technology and Innovation has launched a scientific research and development institute and has introduced a new scientific consultative council under the Ministry. The creation of new institutions has accompanied the consolidation and streamlining of government institutions. The Angolan Academy of Sciences has been established to promote scientific research, disseminate research within the scientific community and society, provide scientific consultancy and encourage best scientific practices and professional ethics. Laws have been passed to regulate the careers and

salaries of scientific researchers. The Foundation for the Development of Science and Technology was created to strengthen the scientific system and is in charge of funding scientific research and implementing STI policies. In addition, the law establishing the organization and structuring of the national STI system was revised to strengthen the innovation system, and assigns higher education institutions a fundamental role in attracting and accommodating entrepreneurial initiatives from civil society through business incubators (Presidential Decree 261/21 of 3 November 2021).

3.2 Entrepreneurship ecosystem

Firms and entrepreneurs are the loci of innovation (Alcorta and Peres, 1998; Fagerberg, 2005; Nelson, 1993). Innovation is a highly uncertain and competitive process. New knowledge needs to be created about upcoming products or processes involving not only scientific inputs but also a practical understanding of their technical and use properties and of the areas in which they can provide the highest payoffs. It is also necessary to develop and integrate competencies in research and development and engineering, product design, production, overall management and the assessment of consumer needs and to link them to upstream and downstream suppliers and distributors. All of this needs to be done before competitors imitate or find alternative ways of bringing into the market similar goods. These qualities are not available in universities or research institutes but are embodied in firms and are available in the entrepreneurs that run firms through the use of their leadership, vision and talent.

Entrepreneurship ecosystems are communities of people and organizations and their underlying information and culture, which participate in and support new venture creation and development, from ideation and launch all the way to growth and scaling. Developing a large and sustained supply of entrepreneurs and an ecosystem of entrepreneurship is fundamental in improving innovative performance in Angola (table 10).

Table 10
Angola: Entrepreneurship ecosystem

Area	Number of institutions	Functions
Awareness and networking	48	Associations, events, networks, competitions
Finance	35	Financial institutions, banks, business angels, microfinance, crowdfunding
Culture	21	Platforms, knowledge-sharing initiatives
Human capital	17	Entrepreneurship competency development
Infrastructure	16	Incubators and accelerators, research centres, laboratories, mentoring initiatives
Policy	9	Entrepreneurship and innovation promotion initiatives

Source: UNCTAD, based on interviews with representatives from the Angola innovation summit.

The entrepreneurship ecosystem in Angola is small but has been growing rapidly in recent years. Under the global entrepreneurship monitor, the total rate of early-stage entrepreneurial activity, which measures the rate of individuals starting or running a new business as a share of the adult population, grew from 22.7 per cent in 2008 to 49.6 per cent in 2020 (Bosma et al., 2021). The global entrepreneurship monitor is based on an adult population survey, focused on the attitudes and activities of a random sample of at least 2,000 adults aged 18–64, based on face-to-face or telephone interviews in each economy, and on a national expert survey, focused on the entrepreneurial context that influences an individual decision to start, sustain and grow a business, based on surveys of local entrepreneurship experts. In Angola, around 89.5 per cent of entrepreneurs started a business to earn a living because jobs were scarce, and over 76 per cent of these were in consumer services and over 51 per cent, were women (Bosma et al., 2021). The

pandemic does not seem to have significantly impacted entrepreneurial activity. In Angola, in 2020, 83 per cent of adults surveyed stated their intention of starting a business in the next three years. Of the 46 countries surveyed under the global entrepreneurship monitor, Angola has the highest total early-stage entrepreneurial activity and the highest share of prospective entrepreneurs, suggesting a significant level of local interest in entrepreneurial activity (Bosma et al., 2021).

The entrepreneurship ecosystem in Angola has been underpinned by several public and private efforts to promote entrepreneurship (Liberato, 2021; UNCTAD, 2020; Embassy of the United States, Angola, et al., 2019). In 2003, the Government launched a unified window for enterprises, which centralized the process of the establishment, modification and closing of enterprises, and by 2021, 19,789 firms had been established under this mechanism. In 2011, the Government, through the law on small and medium-sized enterprises, created the National Institute for Support to Microenterprises and Small and Medium-sized Enterprises, which was tasked with capacity-building, financing, policymaking and the promotion of entrepreneurship. Angola Invests, launched in 2011, and a risk capital fund, launched in 2012, help provide finance for start-ups and small and medium-sized enterprises. Since 2011, the Government has launched several programmes on entrepreneurship and small and medium-sized enterprises, to facilitate the formalization of informal firms, assist small and medium-sized enterprises in applications to financial institutions, establish incubators, reduce bureaucratic procedures and improve the overall business environment. National Development Plan 2018–2022 emphasizes the role of entrepreneurship in development and employment generation, and establishes local centres of entrepreneurship and employment services, to act as local incubators for small and medium-sized enterprises. The link with employment is highlighted in the small business support programme and entrepreneurs' one-stop shop under the programme, which are both aimed at increasing self-employment, as well as the action plan for the promotion of employability, which is focused on generating jobs for youth, partially through new business development.

Different ministries are involved in entrepreneurship initiatives, including the following: Ministry of Economy and Planning; Ministry of Industry and Commerce; Ministry of Justice; Ministry of Public Administration, Labour and Social Security; and Ministry of Telecommunications, Information Technology and Social Communications. Beyond ministries, the National Bank of Angola, in collaboration with the Ministry of Higher Education, Science, Technology and Innovation, has launched the Laboratory for Innovation in the Payments Area, an incubator for the diversification of financial services in the faculty of engineering at Agostinho Neto University. The improvement of the business and regulatory environment is at the centre of government initiatives to foster entrepreneurship. This focus is in line with the priorities of the Ministry of Economy and Planning and is executed through the Production Support, Export Diversification and Import Substitution Programme (Ministry of Economy and Planning, 2018).

There are also various public–private partnerships and private initiatives that promote entrepreneurship. In 2002, the Government, with the United Nations Development Programme and the Chevron Corporation, launched a business programme aimed at developing small and medium-sized enterprises in Angola. In 2020, the United Nations Development Programme signed a memorandum of understanding with the Ministry of Higher Education, Science, Technology and Innovation, aimed at developing entrepreneurship and innovation, to achieve the Sustainable Development Goals by improving interactions between the private and higher education sectors. The Governments of France, the Netherlands and the United States, as well as the European Union and the International Finance Corporation, have also been assisting the Government in the promotion of entrepreneurship. There are also several ongoing initiatives, including the following: Acelera Angola, an incubator and accelerator for small and medium-sized enterprises; Bantu Makers, an incubator helping start-ups develop ideas and resources; Disruption Lab, which promotes an entrepreneurship ecosystem for digital innovation; Fábrica de Sabão, an incubator and accelerator centre providing a workspace and maker space and a platform for exchange;

Founder Institute, an idea-stage accelerator and start-up launch programme; Incuba Angola, an incubator supporting traditional and technology-based small and medium-sized enterprises; Orange Corners, an incubator aimed at helping university students and entrepreneurs get their ideas off the ground; and Start-Up Angola Association, an incubator promoting digital entrepreneurship.

However, results from public and private entrepreneurship initiatives have yet to be achieved. The global entrepreneurship monitor shows that in 2020, the share of entrepreneurs in Angola that appeared able to sustain their business and pay wages over 3.5 years was only 9.2 per cent, among the lowest in Africa. In 2018, the most recent year for which comparable figures were available, the discontinuance rate was 15.2 per cent (Bosma and Kelley, 2018). In addition, 35.2 per cent of start-ups fail while in an incubator and 70 per cent of start-ups fail soon after leaving an incubator (Liberato, 2021). Contrary to expectations, successful entrepreneurships arose not so much among youth in search of employment but as a result of mature, qualified and experienced individuals starting a business after having worked for someone else (Embassy of the United States, Angola, et al., 2019). This finding is consistent with evidence from the United States, where the following patterns of entrepreneurship are observed: the age of founders ranges from around 42–45 years; the average age of founders in the high-technology sector is 43 years; and the average age of founders of patent companies is 45 years (Azoulay et al., 2020). Entrepreneurship in Angola was also the outcome of preferential treatment in the telecommunications, distribution, agribusiness and real estate sectors for local entrepreneurs with connections to the Government (International Finance Corporation, 2019).

The availability of data on innovation remains a challenge. Angola has won international prizes in research and development in areas such as addressing the pandemic and generating electricity, has had several successful innovations in online payments and financial technology, is bolstering a thriving community of digital innovators and has some technologically advanced quality control laboratories in large firms in the food and oil industries. However, overall, the level of innovative performance is low. A business enterprise survey found that few firms had successfully innovated (African Union Development Agency-New Partnership for Africa's Development, 2019). Angola ranked last in the global innovation index in 2021 and is performing below innovation expectations for the national stage of development (World Intellectual Property Organization, 2021).

Overall, the data seem to suggest that while entrepreneurship is well established in Angola, it is mostly of a necessity type, with entrepreneurs finding it difficult to sustain businesses in the long term, let alone to innovate. In this regard, a recent study showed that entrepreneurship is driven more by need and survival than by innovation, characterized by a large gap between the willingness to become entrepreneurs and the required competencies, and with a low level of impact on employment generation (Luanda Entrepreneur Academy, 2021). In addition, necessity-driven entrepreneurship in Angola is consistent with experiences in other less developed economies, which tend to concentrate start-ups in consumer-oriented services, particularly in activities that are less complex, have lower costs and are less intensive with regard to human and financial capital (Pinho, 2017).

3.3 Education subsystem

In Angola, since 1975, higher education has faced many constraints, which has led to many reform processes, particularly in the past 20 years. Constraints are due to economic, social, political, cultural and technological transformations, which affect national performance in teaching, scientific research and university extension. These three pillars act independently, yet are inseparable, and strengthen each other and provide greater robustness to the education system. Conversely, if one of the pillars is more fragile, it can lead to an imbalance in the other pillars, weakening the process of teaching and learning and resulting in deficient human capital development.

In the early 2000s, with the aim of qualifying human resources for national development, there was a boom in private higher education institutions, mainly concentrated in Luanda. This put pressure on the public sector to increase educational offers and reach the provinces, creating academic regions and higher education institutions (Decree of Council of Ministers 5/09 of 7 April 2009). The model of functioning of these academic regions created several constraints that affected the operations of different higher education institutions nationwide. The distance between institutions, combined with mobility difficulties, the dispersal of resources and cultural and development differences, among other factors, led to the need to reorganize the network based on the rationalized management of existing resources, infrastructure, services (libraries, offices), equipment and human resources (Presidential Decree 285/20 of 29 October 2020). This reorganization resulted in the closure of some higher education institutions, the autonomy of others and the creation of three new public universities, namely, the University of Luanda, the University of Namibe and University Rainha Njinga Mbande, increasing the total number of higher education institutions to 11 (the eight others are Agostinho Neto University, Cuito Cuanavale University, José Eduardo dos Santos University, Katyavala Bwila University, Kimpa Vita University, Lueji a Nkonde University, Mandume Ya Ndemufayo University and 11 November University). The only province with two public universities is Luanda (University of Luanda, Agostinho Neto University), which also has the highest number of private higher education institutions, leading to the greatest student population, at 50.87 per cent of the national total (Ministry of Higher Education, Science, Technology and Innovation, 2018).

The increase in supply was reflected in an increase in the student population, from 7,845 in 1999 to 308,309 in 2019, and the annual increase in the number of graduates, which was 21,310 in 2018, of which 9,711 were in public higher education and 11,599, private higher education (Ministry of Higher Education, Science, Technology and Innovation, 2018; Ministry of Higher Education, Science, Technology and Innovation, 2020). The number of graduates is evenly distributed by gender, namely, 10,629 men and 10,681 women. However, in public universities, there are more men graduates (5,511) than women (4,200) and in private universities, there are more women graduates (6,481) than men (5,118). With regard to the age distribution of graduates, the majority are 25–31 years old (8,739). Such a majority, with the projects, expectations and ambitions of youth, places significant social pressure on the job market. Enrolment figures are as follows: social sciences, commerce and law, 44.06 per cent; educational sciences, 20.07 per cent; engineering, manufacturing and production, 14.05 per cent; and health and social protection, 13.06 per cent (Ministry of Higher Education, Science, Technology and Innovation, 2018). There are fewer students in the fields of natural sciences, engineering and technology, agriculture, forestry, fisheries, arts and humanities (Ministry of Higher Education, Science, Technology and Innovation, 2020). One of the greatest difficulties in the creation of training courses in these areas is the high cost of investment, particularly with regard to setting up laboratories and acquiring consumables, which can represent a high level of investment by the private sector, with uncertain returns. In the public sector, investment in these areas depends on the general State budget, which in turn mainly depends on oil revenues. Private higher education institutions play an important role in the training and qualification of human resources in Angola, with the highest number of students, at 53 per cent; 47 per cent of students are in public higher education institutions (Ministry of Higher Education, Science, Technology and Innovation, 2018). This highlights the interest of the population in training and qualification, which reinforces the need for the State to continue to invest in higher education by opening more vacancies in public universities. However, it also shows that the private sector should be seen as a strategic partner in meeting the high level of demand seen in recent years, which is expected to increase.

3.4 The State as the coordinator of the national innovation system

3.4.1 Rebalancing the focus to include technology and innovation

Under the national innovation system of Angola, the science dimension of STI has mainly been emphasized. This appears to be, to some extent, the result of a linear view of the innovation cycle, whereby innovation starts in science, then materializes into technology only after which new products and processes have been created (Balconi et al., 2010; Barbosa de Oliveira, 2014; Godin, 2006). Science is fundamental to the development of technology and innovation and a solid scientific base is required in each country, yet historical evidence suggests that the rapid growth of technology and innovation can build from efforts in the technological base. Countries that have caught up technologically, such as China and the Republic of Korea, have built strong productive and manufacturing capacities by borrowing from scientific advances from abroad and through imitation and, from there, climbing the ladder to the generation of more robust scientific capacities internally and the development of new and advanced technologies (Kim, 1997; Sohn et al., 2009).

The Ministry of Higher Education, Science, Technology and Innovation has not complemented the significant focus on science with new functions focused on generating technological capabilities and developing new products and processes. Diversification into new sectors involves significant innovative efforts, requiring strong connections between STI efforts and existing and planned productive activities. Although often differing widely in approaches, equivalent ministries worldwide have explicit mandates to advance technology and innovation, including among their functions the following: promoting engineering specializations, particular technologies or technological fields and certain sectors; providing technological services; stimulating entrepreneurship and innovation; undertaking foresight exercises, technology assessments and feasibility and technical studies; and creating linkages between scientific research and the needs of innovative firms. The functions of the Ministry of Higher Education, Science, Technology and Innovation include some of these roles, yet its internal organizational structure suggests that the focus of most efforts is on higher education and related research activities. In addition, since the creation of the ministry in 2018, a national directorate of technological development and innovation has not been made operational. At present, the ministry has an adviser to the minister but does not have a department to oversee technology and innovation. The promotion of technology and innovation is mainly under the purview of the Ministry of Economy and Planning.

3.4.1.1 Recommendations

- The Ministry of Higher Education, Science, Technology and Innovation should take a more active role in promoting technology and innovation. In this regard, organizational structures and related mechanisms should be put in place that allow for a closer and more coordinated approach to technological upgrading and innovation under the stewardship or influence of the Ministry

3.4.2 Developing an institutional and organizational structure that delivers

The merging of ministries and rationalization of research institutes may be required, but they should have the required depth and be fit for purpose. Research needs a minimum scale at which to be able to lead to the necessary scientific and technological results and be socially valuable. Isolated contributions, while potentially creating valuable information, often cannot be added to the cumulative process of knowledge creation. Knowledge creation also benefits from economies of scope; knowledge created in some areas complements knowledge created in other areas, to reduce the efforts and costs of scientific and technological discovery.

Many of the research institutes in the national innovation system of Angola lack the required depth. Research by the National Scientific Research Centre is focused on social and life sciences, with the following five research areas: the peoples of Angola; food and nutritional security; bioactive principles; neglected diseases; and phytochemicals. Staff addressing this research agenda include 10 staff members with PhDs; eight, with master's degrees; and 21, with bachelor and professional degrees. At end-2021, the Centre was engaged in two research projects on the impact of climate change on ravines in the Moxico region and on the value of traditional Angolan parasite treatments and two experimental projects on experimental sunflower crops and on contributions to the study of soil fertility in Angola (Ministry of Higher Education, Science, Technology and Innovation, 2014b). The National Technological Centre is working on a broad set of projects in a variety of areas, with limited human and financial resources. Scientific strength can be gained through collaboration, yet the engagement of partners requires both a degree of internal absorptive capacity and the availability of similar research activities within the country. There is no indication of substantive collaboration by these centres, whether locally or abroad.

3.4.2.1 Recommendations

- Decisions to close or merge research or technological institutes should consider the quality of research or technological enhancement and its contribution to society, as well as possible synergies and the consolidation of particular areas. The evolving organizational structure of the national innovation system needs to be assessed in terms of past performance, the possibilities of achieving economies of scale and scope and the developmental potential of the activities undertaken. Official funding should require programmes or institutes to meet minimum standards in areas such as human inputs, relevance, partners, risks, costs, outputs (citations, patents), users, commercialization potential and socioeconomic impact. The proper management of funding incentives can help achieve the right balance between the size of human and financial inputs and expected knowledge outputs and can also help ensure that contributions are of scientific and/or technological significance
- Decisions related to financial support should also be linked to national diversification potential. There are many export and import substitution opportunities in agro-industry (dairy products, cereals, edible fruits and nuts), machinery and mechanical appliances, plastics and articles thereof, iron and steel and pharmaceutical products; support for research and technological development institutes could therefore be related to projects in these sectors in order to connect technological development with the development of production in export and import substitution sectors, thereby adding value to products and accelerating economic growth
- Programmes or institutes that do not meet the criteria should be encouraged to obtain alternative funding and be advised to close or merge, since lack of achievement in the past will be considered in future funding applications. The universities or agencies to which these institutions belong could also be funded on the basis of how successful their research is, which would encourage consolidation within the organizations. The Ministry of Higher Education, Science, Technology and Innovation, as head of the national innovation system, together with its budget allocation capacity, should consolidate and shape the organizational structure of the national innovation system, but to achieve this, the Ministry needs to build research and technology evaluation capacity

3.4.3 Improving implementation capacity

The Ministry of Higher Education, Science, Technology and Innovation needs to improve implementation capacities. The national innovation system plan in 2013 included 62 STI-related projects for the Ministry of Science and Technology and the plan in 2014–2015 included 77 such projects. The plan in 2013 identified 362 such projects for the entire national innovation system but, due to lack of reporting, the plan in 2014–2015 included only 262. There is little information

on the results of most projects and STI plans are no longer developed. Many of the STI-related initiatives and centres launched in 2011 have not delivered or have failed to achieve targets due to the lack of human or financial resources. The magnitude of ambitions needs to be matched with the managerial capacities of the Government. In 2014, the Government requested a loan from the African Development Bank to fund the expansion of the national innovation system; negotiations and obtaining resources have required several years, further delaying activities.

3.4.3.1 Recommendations

- The Ministry of Higher Education, Science, Technology and Innovation needs to improve overall operational planning of the national innovation system and its implementation capacities. STI road maps, calendars, roles and responsibilities, enforceable and realistic targets with measurable indicators and process and content costings need to be established. Initiatives and actions need to be matched with the appropriate type of policy or administrative instrument and the right actor. Establishing a research or technological centre may not be the best solution in all circumstances. Advocacy mechanisms need to be introduced to reach both the highest and the operational levels of the Government and the private sector
- New consultative bodies need to be staffed not only by scientists but also by individuals with managerial and technical expertise, and should have a strong private sector presence. Working groups and cross-government task forces should be established to involve other actors in the process. Initiatives that are not properly resourced through either staff or financing should not be started, to avoid creating an atmosphere of implementation failure
- Learning from other STI initiatives, such as the Programme for the Development of Science and Technology partly funded by the African Development Bank, which has its own management techniques, would add to the managerial capacities of the Ministry of Higher Education, Science, Technology and Innovation. Rather than a "big bang" approach to national innovation system growth, a more project-driven method, with a few initiatives first proving the value of a concept, followed by piloting of the underlying ideas or projects, then scaling up, seems warranted. A few successful projects can have more impact than several uncompleted ones. Once this implementation approach has proved successful, it can be rolled over across numerous STI-related initiatives of the Ministry

3.4.4 Ensuring that actors cooperate and learn from each other

In a well-functioning national innovation system, institutes, firms and private and public initiatives communicate and operate well together and work towards a common purpose. The more they work together, the more synergies and learning can be achieved, resulting in stronger competencies and greater innovative performance (Audretsch and Belitski, 2022; Edquist, 2005). Articulation is necessary at all levels, for example, between STI functions, between government institutions, universities and the private sector, between users and producers and between firms and suppliers. Major learning benefits and better individual results can be obtained through knowledge-sharing, collaboration and networking. Achieving individual organizational objectives often depends on the actions of other organizations and institutions.

In this regard, in Angola, a weakness in the national innovation system that still needs to be addressed is institutional fragmentation and the lack of coordination between actors. The silo approach of government agencies was highlighted by many of the interviewees during the preparation of the present review. Lack of communications and collaboration between entities, lack of a holistic approach, the need for better articulation between entities and organizations and between them and entrepreneurs and the absence of a coordinated STI and industrial policy are weaknesses that have been considered in recent reports (Luanda Entrepreneur Academy, 2021; Liberato, 2021; UNCTAD, 2020).

The national innovation system of Angola is characterized by a diversity of institutions, programmes and initiatives. Individual agencies plan and execute actions without consulting or informing other agencies and without working with them to achieve common objectives. This issue is seen both across ministries and public institutions and within them. The situation became evident following the national innovation system plan in 2014–2015 under which, except for a few ministries, most public sector actors did not provide information on STI programmes and projects that would have helped to achieve the objectives of the plan. Information-sharing could not be coordinated across government agencies and the Ministry of Science and Technology alone had to pursue achievement of the STI strategy; its activities made up most of the national innovation system.

In addressing the coordination challenge, the apex of the national innovation system should first be considered, particularly the functional separation between science, under the Ministry of Higher Education, Science, Technology and Innovation, and technology and innovation, under the Ministry of Economy and Planning. From a national innovation system perspective, a concern is the absence of the Ministry of Higher Education, Science, Technology and Innovation in the organization of the Production Support, Export Diversification and Import Substitution Programme. The Ministry is currently implementing some of the initiatives under the Programme, such as the Laboratory for Innovation in the Payments Area incubator, but the extent of integration with other initiatives is unclear. More importantly, as noted, the separation of higher education and science from technology and innovation can lead to underperformance in both areas. The Ministry could perform a leading role in bridging efforts in both areas. There is significant potential for improving coordination in the national innovation system through the inclusion of the Ministry in the current governance set-up of the Programme.

Some design and implementation deficiencies could also be corrected. The Production Support, Export Diversification and Import Substitution Programme is centralized, under the responsibility of the President and the Ministry of Economy and Planning (Development Bank of Angola, 2019). Its top-down approach results in the lack of involvement from lower levels of the administration. In addition, there is significant political will to implement the Programme, yet delivery depends on a number of institutions with different capacity levels, which may have concerns about budgetary constraints, additional tasks and the authority of the Ministry of Economy and Planning. The lack of involvement by other agencies leads to delays in the achievement of objectives, and targets are not yet being revised and adapted to what is feasible, thereby reducing the credibility of the Programme among the institutions involved and increasing apathy. Information does not appear to flow as expected, as measures are not properly communicated and there is little financial reporting or reporting on results.

3.4.4.1 Recommendations

- Incorporate the Ministry of Higher Education, Science, Technology and Innovation into the Intersectoral Commission of the Production Support, Export Diversification and Import Substitution Programme. Including the Ministry in the Programme leadership will signal that technology upgrading and innovation are intended to be at the centre of industrial development. Coordination of the national innovation system could also benefit from techniques adapted from the field of technology and innovation management (Clark and Wheelwright, 1992)
- Any new initiative should be preceded by a charter or document setting out the objectives, the required activities and the targets to be met. The private sector, where relevant, should be involved in the development of such a charter and in the subsequent process. The charter should be discussed with the ministries, agencies and other stakeholders involved before any programme is begun, and revised as changes take place

- Once the charter is agreed, a detailed operational plan for agencies and stakeholders should be established. Planning should include participation by the staff to be involved in the initiative, bringing in different hierarchical levels, followed by the formation of an inter-agency team tasked with implementing the charter. The team should thereafter be responsible for implementation of the initiative, rather than the Ministry of Economy and Planning
- Team members from all involved agencies and stakeholders should be clearly identifiable and their roles, responsibilities, time allocations and performance criteria spelled out. Teams should prepare information dissemination, communications and reporting plans. Agencies to which team members belong should agree to and facilitate team involvement, including participating in joint staff evaluations with other offices. Through work in purpose-built inter-agency teams, implementation responsibilities become decentralized and multidisciplinary, facilitating interaction, cooperation and coordination. By working together as equals, team members can learn about each other's perspectives and thereby accelerate implementation. Where necessary, funding for team activities should be provided by the Government. The leadership of teams should continue to be at a high level and responsibility should be at the level of the Ministry of Economy and Planning and the Ministry of Higher Education, Science, Technology and Innovation, either together or on a rotating basis, and applied through the provision of information and coordination, as well as by evaluating the work of team members, liaising with the Cabinet and championing and communicating team activities

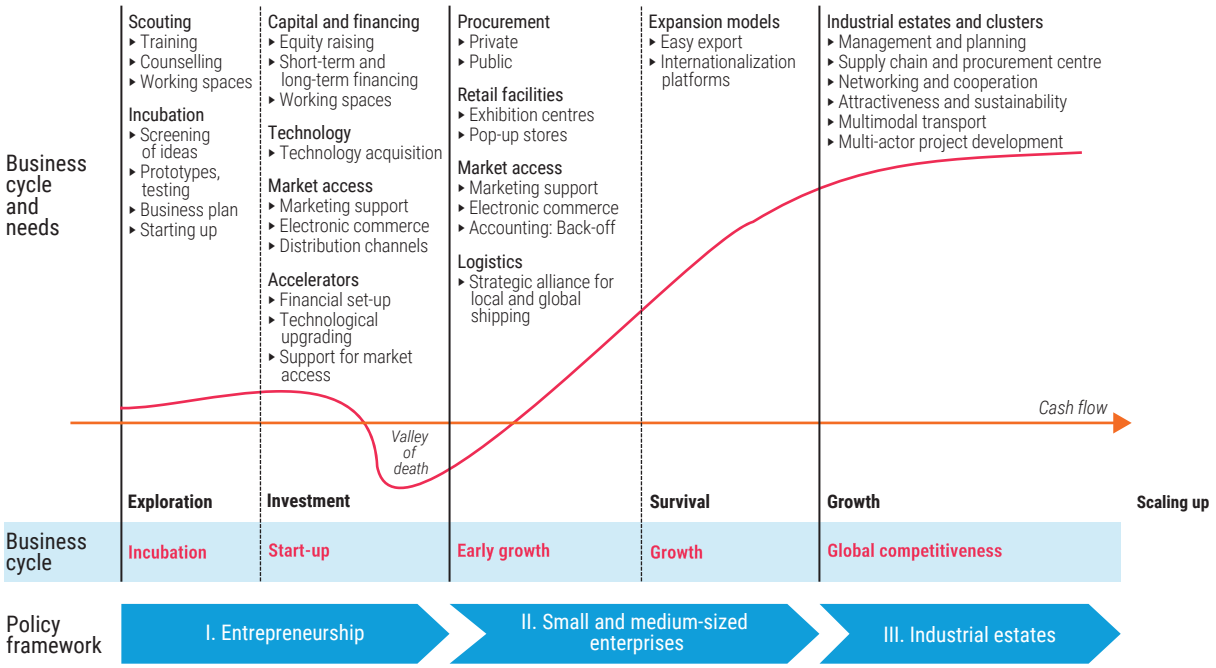
3.4.5 Focusing on innovative entrepreneurship

The entrepreneurship ecosystem in Angola appears to be weak in inception, particularly with regard to public resources. Due to low oil prices, the country has been facing a recession since 2014 and, as a result, total unemployment is around 33 per cent of the economically active population and over 56 per cent of those aged 15–24, leading to an increase in income poverty among 40.6 per cent of the total population (Luanda Entrepreneur Academy, 2021). The Government is implementing entrepreneurship programmes to address issues related to unemployment and poverty. However, while unemployment and entrepreneurship programmes both provide training and finance as support mechanisms, the content and objectives of the mechanisms should be different.

The establishment of an effective entrepreneurship ecosystem that changes the nature of entrepreneurs from necessity to opportunity driven and drives the national innovation system towards a high level of innovative performance is complex and needs to be built on clear objectives and a particular focus. Coevolutionary processes involving the different stages of firm development, the diverse needs of firms as they grow, the supply of changing amounts of liquidity as new challenges emerge and the various policy approaches required at each stage of the business cycle each need to be individually calibrated to the highest standard. At the same time, they need to be in synergy with each other, to improve results (figure 20). Stages often overlap, feed into each other in multiple directions and ways and do not have clear borders, which further complicates the formation of an articulated ecosystem. The basic input of entrepreneurship ecosystems is an idea or concept that, if successful, materializes into a small firm, which may grow into a large firm by expanding either domestically or internationally. Large firms may grow even further locally or become a multinational enterprise with individual plants located in industrial estates or clusters and forming a part of value chains worldwide. The initial idea should be for a product or service that supplies something needed by society and that will be profitable for the entrepreneur. Ideas should have a market, be technically and financially feasible and be compatible with the skills of the creator. They should also be in line with existing regulations and be environmentally friendly. Often, ideas need to be novel, whether they are new locally or to a particular industry.

Figure 20

Business cycle, needs and policy framework



Source: UNCTAD, based on Spitzer, 2020.

A design challenge with regard to entrepreneurship ecosystems is in distinguishing business start-ups from technology-based and innovative activity. A large proportion of start-up activity in Angola is in the services sector, particularly in the wholesale and retail sector, which accounted for 74 per cent of all start-ups in 2018 (Bosma and Kelley, 2018). These are basic-skill entrepreneurial activities. By contrast, the growth of technology-based activities and start-ups with novel ideas is more complex. The knowledge involved is more specialized; prototyping and testing generally requires unique equipment and engineering expertise; the sources of technology are more diverse, including suppliers and universities; internal research and development activities may be required; financial investments tend to be significant; and marketing and distribution channels, both domestically and abroad, often do not exist. When ideas novel to a country are involved, foreign technical and knowledge inputs are usually crucial. In addition, the entrepreneurs involved in such high-skill projects are likely to be older, experienced and knowledgeable in their fields.

3.4.5.1 Recommendations

- The official entrepreneurship support programmes in Angola need to shift towards supporting individuals with the best business ideas, with criteria for assessing ideas used as the main support requirement. As not all unemployed members of the population will become entrepreneurs, the qualification criterion for an entrepreneurship programme should not be employment status but the soundness of a business idea. This does not mean eliminating necessity-driven entrepreneurship, as some such entrepreneurs may turn into good businesspeople, but focusing on or helping to develop good business propositions. The purpose of an entrepreneurship ecosystem is to create dynamic firms, not to generate employment. Employment will follow if the ecosystem is successful
- Develop a two-tier support approach to entrepreneurship ecosystem-building, to deal with differences in entrepreneurial skill levels. A basic business support tier, ensuring that the

business case is well developed, addressing basic management and business skills and providing "hand-holding" for the entrepreneur until their idea gets off the ground, could focus mainly on necessity-driven entrepreneurs. A more technically oriented support tier, linked to universities and research centres and assisted by technology or industry-specific institutes, funding and bank collateral mechanisms and international collaborations, could focus mainly on opportunity-driven entrepreneurs and those developing ideas not seen before in Angola. Both tiers would require working with close connections in order for the projects of necessity-driven entrepreneurs, as they grow and potential or demand for technical inputs is identified, to be shifted to the second, high-technology tier. Entrepreneurs with technically unfeasible concepts can be moved to the basic tier. The promotion of entrepreneurship of opportunity and entrepreneurship of necessity requires different sets of policies, yet they need not be mutually exclusive but can complement each other (UNCTAD, 2020)

- Government and private investment should establish mechanisms and facilitate the interactions required to develop the second entrepreneurship ecosystem-building tier. To avoid excessive expenditure, initial efforts should be related to the diversification priorities concerning exports and import substitution. The Ministry of Higher Education, Science, Technology and Innovation could take the lead, in close collaboration with the Ministry of Economy and Planning and the ministries responsible for different sectors. In this way, national and sectoral or regional innovation systems can be brought together and made to work in a coordinated manner
- A national entrepreneurial strategy should be prepared, with clear objectives and a strong and operational institutional framework (UNCTAD, 2020). This may help provide efficient coordination between the various institutions working in entrepreneurship and innovation and help put in place sound measurement and policy-learning mechanisms. In addition, a strategy prepared on the basis of broad participation could allow for other problems in the business environment to be addressed, including limitations in human capital, deficient infrastructure (quality and price of electricity, water, Internet services), lack of access to finance, absence of an entrepreneurial and innovation culture, excessive bureaucracy and corruption and insufficient government policy and regulation (Luanda Entrepreneur Academy, 2021; Liberato, 2021)

3.4.6 Encouraging development priorities without limiting scientific freedom

The Government is making efforts to increase the scientific capacity of the national innovation system. Together with the restructuring of research institutes and the improvement of the quality of teaching, the Government has negotiated with Elsevier access for three years to scientific literature for about 3,000 professors and scientific researchers from about 40 Institutions. To improve the environment for scientific research and connect to international scientific databases, the Government has created a network of scientific journals and a national open access scientific repository, in partnership with the United Nations Educational, Scientific and Cultural Organization and other international partners. The Programme for the Development of Science and Technology is financing research projects and postgraduate scholarships and carrying out activities to promote and strengthen the participation of women in science and technology.

3.4.6.1 Recommendations

- The Ministry of Higher Education, Science, Technology and Innovation should increase science-related funding, to prevent falling behind global performance, in addition to improving the organizational structure of higher education and research institutes, which could help save resources. However, such an increase should not be too significant, given that budgetary constraints will remain, except possibly temporarily if the price of oil rises. Such constraints can only be eased through rapid growth, for which Angola needs to first build technological and productive capacities

- The Ministry of Higher Education, Science, Technology and Innovation should focus science-related support on priority areas for economic diversification, suggesting that greater efforts are required to increase national engineering and technological capacity. However, since not all areas can be developed, priority needs to be given to those in which there is growth potential. As scientific capabilities emerge in certain areas, it makes sense to match these with manufacturing priorities. There is a clear overlap between medicine and biology and the pharmaceutical industry, between chemistry and biology and the plastics and iron and steel industries and between biology and agricultural sciences and agro-industry, and particular technologies, products and processes need to be identified to ensure fruitful interactions between science and industry. Some new areas of scientific and technological expertise could be developed, although this could be costly. Identifying common scientific contents, research efforts, technological developments and industry priorities can help address the challenge of establishing closer university and industry links and partnerships. The Government should allocate a significant proportion of resources to priorities and incentivize joint university and industry projects in these areas for the common good, but does not have to place all expenditure in this area. Scientific freedom and independent inquiry are critical for the advancement of science and could help uncover new avenues for developing priority activities. Scientific freedom should also be respected and encouraged through some government support and by targeting private and/or international support and funding

3.4.7 Increasing research and development expenditure

Research and development expenditure in Angola is among the lowest in the world. Such expenditure increased in the formation years of the national innovation system but declined after 2014, in line with the retraction of the national economy. In 2016, Angola spent $66.2 million or around $2.3 per capita (purchasing power parity) on research and development, roughly equally divided between the Government and the higher education sector. Over half of research and development expenditure is dedicated to applied research, and most research and development expenditure is current expenditure, particularly wages; the social sciences account for around 54 per cent of total expenditure (table 11). There is little research and development capital investment, and expenditure on technology barely exceeds 2 per cent of total government and higher education outlays.

Table 11

Angola: Research and development expenditure by type of institution, 2016

	Millions of dollars (purchasing power parity)	**Share of gross domestic product** (percentage)	**Share per capita** (dollars; purchasing power parity)
	Government expenditure on research and development		
2016	33.70	0.016	1.17
2014	20.14	0.01	0.74
2011	61.30	0.05	2.53
	Higher education expenditure on research and development		
2016	32.50	0.016	1.12
2014	22.70	0.01	0.84
2011	24.30	0.02	1.00
	Total official expenditure on research and development		
2016	66.20	0.032	2.30
2014	42.84	0.02	1.59
2011	85.60	0.07	3.53

Source: UNCTAD calculations, based on African Union Development Agency-New Partnership for Africa's Development, 2014, African Union Development Agency-New Partnership for Africa's Development, 2019, and data from the Institute for Statistics, United Nations Educational, Scientific and Cultural Organization.

With regard to the limited research and development expenditure, the Government has invested $100 million over five years in STI, partially financed from a loan from the African Development Bank, to increase STI expenditure (table 12). Yet more is required. In 2020, only around 5 per cent of the budget was allocated to education, including higher education, and the Government aims to increase the allocation in 2022.

Table 12
Angola: Research and development expenditure, 2016
(Millions of dollars; purchasing power parity)

Type of research	
Applied	34 162.7
Basic	21 879.5
Experimental development	10 116.7
Total	66 159.0
Type of cost	
Labour	37 321.1
Other current	24 054.8
Machinery and equipment	4 726.4
Land and buildings	56.7
Total	66 159.0
Field	
Social sciences	35 719.0
Agricultural and veterinary sciences	14 016.7
Medical and health sciences	10 497.2
Natural sciences	4 530.6
Engineering and technology	1 395.5
Humanities and the arts	–
Total	66 159.0

Source: UNCTAD calculations, based on data from the Institute for Statistics, United Nations Educational, Scientific and Cultural Organization.

3.4.7.1 Recommendations

- The Government should increase the budget allocated to research and development, to meet the target of 1 per cent of GDP for research and development. Such an increase will promote the creation of research-related "critical mass", to support manufacturing and productive development priorities and progress in achieving the Sustainable Development Goals. The Government may wish to consider further expanding the budget for STI through the use of possible windfalls from the current rise in oil prices, reallocations in the internal government budget, further international borrowing and the attraction of private funding to STI research and development. In the long term, a greater proportion of government expenditure in education should be targeted

3.4.8 Nurturing human capital

Both the volume and quality of inputs determine the innovative performance level of a national innovation system. According to the Institute for Statistics, United Nations Educational, Scientific and Cultural Organization, in 2016, Angola had 827.5 full-time equivalent personnel in the government and higher education sector, who seem to be thinly spread across institutions (table 13). The total number of employed in the official research and development sector is 2,153,

which is the fourth lowest figure among countries in Africa for which data are available. Total research and development personnel per million inhabitants is 28.7, also low among countries in Africa for which data are available. However, Angola has a better performance level under the indicator on expenditure per researcher, amounting to $121.9, close to the average of $141.6 in sub-Saharan Africa, suggesting that local researchers have some support to undertake activities. The majority of research and development personnel are researchers, accounting for nearly two thirds of the total. With regard to fields, natural sciences and agriculture and veterinary sciences account for 57.2 per cent of the total and with regard to gender, women make up less than 30 per cent of the total. The data on personnel highlight the concentration of research on agriculture and the weakness in engineering and technology, in which there are 38.6 full-time equivalent personnel in the government and higher education sector. This further underscores the need for consolidation and prioritization, particularly with regard to technological development, as the numbers necessary to reach critical mass in most fields have not yet been reached.

Table 13

Angola: Research and development personnel, 2016
(Full time equivalent)

Total research and development personnel by type of institution	**827.5**
Government	508.5
Higher education	319.0
Total research and development personnel by function	**827.5**
Researchers	542.7
Technicians	150.0
Other supporting staff	134.8
Researchers	**542.7**
of which:	
Government	266.5
Higher education	276.2
Women	**156.9**
Natural sciences	155.5
Agricultural and veterinary sciences	154.9
Social sciences	119.3
Medical and health sciences	47.0
Engineering and technology	38.6
Humanities and the arts	27.4

Source: UNCTAD calculations, based on data from the Institute for Statistics, United Nations Educational, Scientific and Cultural Organization.

Another challenge is with regard to the quality of local human resources. Higher education public institutes have been reorganized, there is better access to scientific literature, a full evaluation has been conducted of the higher education institution curriculums and research departments, a request has been made for higher education institutions to start self-assessment processes to determine the extent of their alignment with international standards and indicators of performance and quality, a programme of teacher training is now coupled with mandatory assessments of teacher performance and the appointment of academic management and a higher education academic career statute has been approved. However, more work needs to be done to improve the quality of research at higher education institutions. Academic staff at higher education institutions and government research institutes have made their careers almost exclusively based

on teaching or administrative activities (Mussamo, 2019). In the private sector, both education and corporate, there has not been a tradition of research and technology development, due in part to a drive for short-term profits and quick gains, poor management, few incentives for academics, the progressive deterioration of the infrastructure of universities and related institutes and limited finance. Research at universities and related institutes has been directed towards literature reviews, problem analysis or framework preparation rather than the application of knowledge and conversion to technical designs, prototypes and new products (Mussamo, 2019). Related technical infrastructure, laboratories and equipment, usually provided by the Government, are not often used or maintained and are not put to value-generating use. Scientific and technological research has not been conceived with the aim of having an economic or social impact. University and industry collaborations have therefore been lacking.

A local initiative with some features that can help shape the quality of the human capital emerging from higher education is the Higher Polytechnic Institute of Technology and Science, formed in 2005 as a private sector project by Sonangol to prepare human resources for a career in support of the oil industry (box 3). By 2012, the institute had expanded to cover six engineering (mechanical, construction, electrical, information technology, chemical and industrial production) and two social sciences (economics and management) programmes, and programmes in petroleum engineering, geosciences and accountancy have since been added, as have specializations and master's-level programmes.

Box 3

Angola: Higher Polytechnic Institute of Technology and Science

As a technical university, the focus of the activities of the institute is on technological innovation. Educational programmes have a skills component aimed at facilitating the emergence of problem-solving and creative skills among students. Apart from an applied and practical focus, skills are developed through the continuous encouragement of students, to develop concrete projects subject to critiques by lecturers, with some projects chosen to move on to a mentoring stage by outside supervisors, mainly from industry. Proactive students with new ideas are assisted in establishing start-ups. Student efforts, university research projects and technological fairs undertaken by the institute are all part of the 60 applied sciences research projects that are aimed at three patent applications. The approach of the institute is well established in developed countries but less so in Angola. Building on contacts and support from the oil industry, the institute has built 34 laboratories to assist the educational programmes, some of which could be used in support of industry, although local companies seem to prefer to use foreign laboratories to meet their needs. However, inroads into the private sector are being made in testing, certification and quality control in the chemical (water treatment), mechanical (destructive and non-destructive material analysis), electrical (cable certification), civil (cement and concrete) and geothermal (topography) fields. Through these services, better relationships with industry may be established, leading to more substantial interactions. Other significant initiatives of the institute are training and post-graduation job placement. Building on oil industry contacts and the services provided to companies, the institute has been able to diversify links with the food, chemicals, telecommunications, metallurgy and oil industries. With regard to training, short courses are provided in the oil and telecommunications industries and discussions are ongoing with other industries. In addition, the institute has agreements in these industries for placing students following graduation. The institute states that all graduates find jobs, with demand from the industry creating waiting lists for new employees from the cohort of graduates of the institute, at 25–30 per cent in the chemicals industry, 25–30 per cent in the information technology industry, 15 per cent in mechanical industries and 15 per cent in economic and management jobs across industries.

Source: UNCTAD.

The improvement of the quality of academics and students needs to be accompanied by a similar improvement among entrepreneurs. Most entrepreneurs in Angola are informal and many aspiring entrepreneurs need to improve their skills. There is a confident local attitude towards entrepreneurship yet an entrepreneurship culture needs to be developed. As highlighted by many

of the interviewees during the preparation of the present review, the lack of human capital capable of developing and incorporating innovative processes within organizations is a critical limitation to business development; it is beginning to emerge yet more time is required before innovative performance improves. The dominance of sectors that rely on oil rents limits the growth of true entrepreneurship (International Finance Corporation, 2019). There is much to be done before an entrepreneurial culture can emerge and to ensure that more people are aware of opportunities related to entrepreneurship (Embassy of the United States, Angola, et al., 2019).

The national innovation system and entrepreneurs are hindered not only by human resources limitations with regard to researchers and entrepreneurs but also by the general quality of graduate and professional labour. Interviews with entrepreneurs, financial institutions and other relevant stakeholders showed that they believed that the quality of the workforce was weak, lacked ethics and professional deontological ethics and faced different types of linguistic difficulties, whether written, oral or related to the interpretation of information or the logical organization of ideas (Liberato, 2021).

A strategy aimed at fostering national development and diversification into new manufacturing sectors needs to rely on close university and industry partnerships. A possible prioritization of sectors and products, to support the design of an industrial diversification strategy, is presented in chapter 5. However, the evidence presented in this review highlights the need to also strengthen university and industry partnerships and the capabilities of universities and research centres, to produce new knowledge that can be functional and transferred to industry.

Changing structural conditions takes time and requires long-term human resources strategies and planning. The Government may already be taking steps in the right direction yet it is crucial to also change the incentive system.

3.4.8.1 Recommendations

- The Ministry of Higher Education, Science, Technology and Innovation should shift monetary rewards and moral encouragement towards non-teaching activities. This may not be easy in the context of a teaching culture and financial constraints and it will therefore be necessary to prioritize. Incentives should be accompanied by an increase in the number of visits, exchanges and training programmes with higher education institutions abroad. The natural attrition of older academic staff should be carefully managed, with a more research and technology-oriented profile for new staff. Hiring and promotion should be merit-based. Investment in laboratories and equipment should be increased
- The Ministry of Higher Education, Science, Technology and Innovation should implement a conscientious, strict and research-focused process of certification for all private and public higher education and research institutes, emphasizing scientific and applied research. Encouraging institutions and providing temporary incentives to the corporate private sector to both invest in in-house research and development and work more closely with universities and research institutes should also be part of the approach of the Government
- In the transition period, the Angolan diaspora and foreign academics could be invited on a short-term or medium-term basis to support the renewed higher education sector in Angola. International partnerships and participation in international research projects should be encouraged and additional donor funding and international finance should be procured for this purpose
- The university and industry partnership methods of the Higher Polytechnic Institute of Technology and Science are relatively new to Angola; such approaches have been well tested internationally and could therefore be attempted by others in Angola, despite related challenges. Some of the industries in which these partnerships are being attempted overlap with priority

industries and some initial technological efforts are therefore already taking place; university–industry partnerships could therefore be facilitated through the coordination of such initiatives

- Most observers of entrepreneurship in Angola suggest entrepreneurship education as the main mechanism for dealing with related challenges. Debate on whether education creates entrepreneurs or merely facilitates their development is ongoing, yet significant efforts are being made, such as those of the Higher Polytechnic Institute of Technology and Science. UNCTAD (2020) emphasizes the importance of the teaching of entrepreneurship at the secondary, technical and tertiary levels but notes with concern the planned elimination of business studies from secondary school curriculums and the low quality of entrepreneurship teaching. Universities and technical professional centres could shift entrepreneurship education towards experiential learning as the best way to develop the competencies required to bring about a critical mass of young entrepreneurs (Embassy of the United States, Angola, et al., 2019).
- Improving the quality of the workforce requires a fundamental rethinking of the standards of secondary and tertiary education and technical and vocational education and training. Education at all levels should be less theoretical and more experience-based and involve learning by doing, and a monitoring and evaluation entity should be established for all levels (Luanda Entrepreneur Academy, 2021)

3.4.9 Attracting investment and finance

Financing for the national innovation system comes from many sources. The public sector supports innovative activity through its budget and financing programmes. The Government can also raise funding in international markets, such as the loan of $90 million from the African Development Bank, and can obtain funding from donors and non-governmental organizations for technology and innovation projects. The private sector funds research and development from own resources and financial institutions contribute to entrepreneurial initiatives.

An important recent funding initiative by the Government is the establishment of the Foundation for the Development of Science and Technology in 2021. Its mandate is to finance scientific and technological projects from budgetary and extrabudgetary sources and to evaluate and accredit institutions dedicated to scientific and technological research, which are part of the national STI system. At the time of the preparation of the present review, the Foundation was in the process of being established, hiring personnel and negotiating a budget with the Government, and aimed to call for proposals in 2022. There were plans to fund medical sciences, biology, agriculture, engineering, water, the circular economy and solar energy. The establishment of the Foundation is a major step forward in the development of the national innovation system of Angola. For the first time, Angola has a funding mechanism for STI and, together with already existing research funding through the loan from the African Development Bank, it can contribute significantly to the advancement of STI projects in Angola.

Similar institutions in other countries have sought to address two risks in implementing their functions. First, the broad nature of the funding demands such institutions might face, which means that if the list of areas for funding is broad, with a limited availability of funds, it is difficult to satisfy many projects or funding per project may be thin and therefore ineffective and, if the technological expertise of the institution is weak, the guidance provided tends to drive resources mainly into scientific fields. Second, the lack of capacity to deal with the various functions of such institutions. Financing and accreditation and evaluation are different domains of public administration; financing and evaluation are different specializations that draw on different competencies. By sharing an administration, institutions may save on administrative costs, but then need to uncover ways of finding synergies between project financing activities and institutional evaluation activities in order to avoid the creation of silos.

With regard to private funding, since most companies do not have research and development and engineering departments, little private funding is taking place. There may be some innovative activities in other corporate departments yet data is not available. The main mechanism for the private funding of innovation is through the funding of entrepreneurial activity by financial institutions.

As noted in the literature, access to finance is one of the most challenging aspects of the entrepreneurial ecosystem in Angola. Many entrepreneurial initiatives fail due to the lack of finance. In 2020, under the "access to entrepreneurial finance" component of the global entrepreneurship monitor, Angola ranked 44 of 45 countries, ahead of Burkina Faso. UNCTAD (2020) has noted that Angola has the third largest financial sector in sub-Saharan Africa, yet less than one third of the population has a bank account and only 18 per cent of small and medium-sized enterprises obtain finance from banks. There are few venture capitals and only two financial institutions provide seed capital for start-ups. Banks consider entrepreneurial initiatives as high risk and entrepreneurs need to have their own financing or borrow from families (Liberato, 2021).

A study on entrepreneurship found that in recent years, there has been an increase in the number of institutions, instruments available and volumes of credit to entrepreneurs, but more is required (Luanda Entrepreneur Academy, 2021). The study recommended improving lending conditions for entrepreneurs, including interest rates, collaterals and bureaucracy; disseminating information about financing sources; promoting the establishment of entities specializing in start-up finance, such as venture capital, business angels, crowdsourcing and crowd financing; establishing a favourable fiscal regime for high-risk funding entities; sensitizing existing financial institutions to the challenges faced by start-ups; establishing entrepreneurship funds; and creating a community of institutions specializing in entrepreneurship finance.

3.4.9.1 Recommendations

- Angola should increase short-term and long-term finance for the national innovation system. In the short-term, a greater budget should be allocated to certain elements. Initially, efficiency saving and the reallocation of funds will be needed. The Government may seek further international finance on the back of successful implementation of the loan from the African Development Bank. More work with international partners and donor countries could lead to some additional funding. However, the main area of expansion of finance for the national innovation system should come from the private sector through higher levels of investment in research and development and innovation by large firms and through the banking system, by lessening conservative lending practices. A rapidly expanding economy and manufacturing industry would contribute greatly to this goal
- The Foundation for the Development of Science and Technology should carefully balance the allocation of resources between science and technology and establish a set of particular and narrow priorities in order that funding can make an impact. In addition, priorities should be aligned with national development and manufacturing priorities

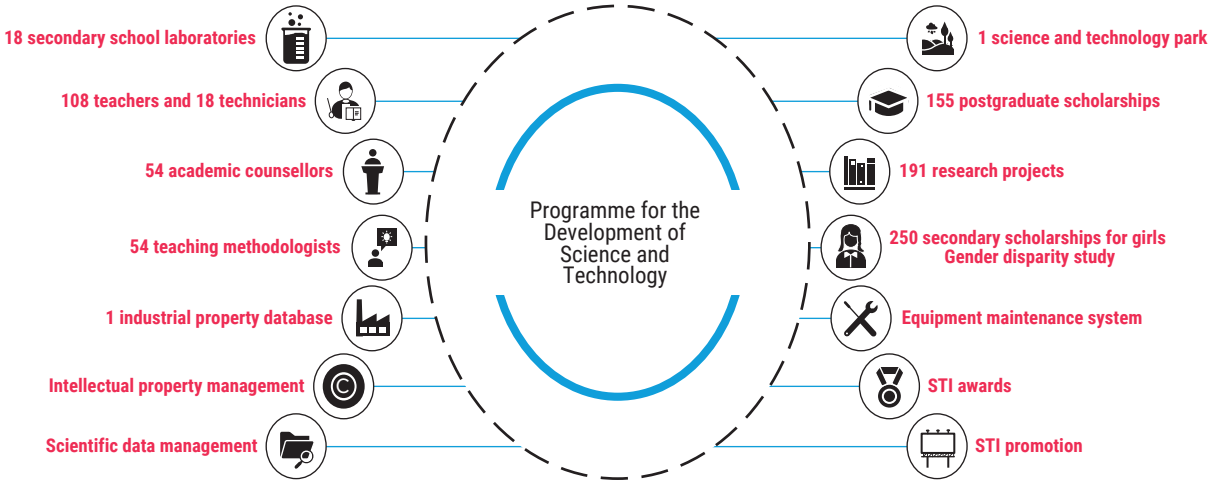
3.4.10 Using carrots as often as sticks

Current national STI policy efforts date to 2011, with the issuance of the national STI strategy 2011–2016, the national STI policy and the coordinating mechanism of the national system of STI (Government of Angola, 2021). In implementing the policies, focus has mainly been placed on institutional and organizational programmes aimed at building the national innovation system and its components, including through STI projects, the most important of which is the Programme for the Development of Science and Technology (90 per cent of its funding is from the African Development Bank and 10 per cent by the Government), for which the Ministry of Higher Education, Science, Technology and Innovation is the executing agency. The programme is aimed at contributing to the diversification of the economy through science and technology, including by supporting related

activities in priority areas and by creating a favourable environment for STI. The main activities include constructing a science and technology park; funding scholarships and research projects; involving women in STI; developing STI competencies in secondary schools; and providing support related to intellectual property (figure 21).

Figure 21

Angola: Programme for the Development of Science and Technology key performance indicators



Source: UNCTAD.

Work began under the programme after 2018. The greatest investment has been in the science and technology park, at 50 per cent of total investment; equipment and maintenance account for around 10 per cent, secondary school development accounts for around 10 per cent, methodologies account for 6 per cent and project management accounts for 5 per cent. Expenditure on equipment and maintenance, teaching methodologies, teachers, counsellors and technicians includes 54 laboratories in 18 schools; a high proportion of the programme is focused on secondary schooling. With regard to intellectual property, the programme is funding an information technology system for the Angolan Institute of Industrial Property, management upgrading and awareness-raising with regard to intellectual property.

The science and technology park has a triple helix approach, bringing together the Government, universities and the private sector, and is expected to be self-financing in the long term. The park studies, including technical and marketing aspects, have been commissioned to a company in Spain and construction is expected to begin in 2022 and be completed within two years. The main challenge is in attracting companies to the park, with discussions to find ways to collaborate being held with the Huawei company, which is exploring the establishment of a separate park. As this is the first park of this nature in Angola, discussions are also taking place with the Production Support, Export Diversification and Import Substitution Programme, for further learning in park development. The park is aimed at contributing to addressing key problems in society by covering all areas of the natural and social sciences, and will be a general rather than a specialized park. The park is well designed, financed by an international organization and has a management and development team of an international calibre and with clear rules of implementation.

However, some significant challenges have arisen. The general focus of the science and technology park may spread resources thin and further contribute to the lack of depth and the concentration on science under the national innovation system. In addition, if it does not focus on technologies for priority sectors, it may go against the project objectives of diversification of the economy. The park does not have to be purely general or purely specialized yet can be socially justifiable and

have long-term impacts only if it contributes significantly to the sectoral priorities of Angola and under the Production Support, Export Diversification and Import Substitution Programme. The lack of firm involvement is another concern. Without firms, there is no innovation, and the absence of firms means that the park may not have economic value, with little or no activity and use only by the scientific community. Operational income needs to come from firms and their absence affects the daily finances of the park. Obtaining large international partners is a good short-term solution and may help improve technological capacity in some areas, but one of the key roles of such a park is to generate spillovers; the more firms are involved, the greater the spillovers, and the more local firms are involved, the better for national development. Another related concern is the long-term sustainability of the park. Large STI-related projects are often built without due consideration of how they will be maintained in future. A self-financing approach is the best option yet, as this has not been guaranteed for the park, an alternative financial sustainability plan should be put in place, to avoid the disuse and possible closure of the park.

With regard to policies under the national innovation system, an element that appears to be lacking is incentives. Most such systems worldwide use incentives or inducements to shape the behaviour of stakeholders. Incentives can be applied not only to researches but also to other individuals involved in a national innovation system, including those within government organizations, as well as to enterprises and even foreign financial institutions that may offer local support if there is an attractive proposition by the Government or local partner. Resilience, creativity and innovation capacity are present in Angola but have not yet been stimulated enough (Liberato, 2021).

A taxonomy of industrial policy developed by Weiss (2015) is also applicable to technology and innovation policy at early stages of development. Countries at this stage generally attempt to diversify economies, increase value addition to natural resources, attract FDI to generate technology and encourage start-up firms. There are five market areas in which such policies should be applied, namely, product, capital, land, labour and technology, whereby new product development could benefit from tax credits and investment or FDI incentives; influencing of financial markets could benefit from directed credit and interest rate subsidies; rendering land rental prices more attractive could benefit from subsidized rentals; improvement of the quality of labour could benefit from wage tax credits or subsidies and training grants; and technological change could benefit from research and development subsidies and grants, with the exact moment of application of such support considered carefully (Weiss, 2015). Incentives can be expensive for taxpayers. However, some of the suggested incentives could be explored in Angola, including an analysis of those that would be consistent with existing fiscal constraints, as they could become powerful tools in driving firms to innovate.

3.4.10.1 Recommendations

- The need to introduce incentives raises the issue of considering a new set of policies for and approaches to the national innovation system. Nearly 15 years have elapsed since the initial STI review by UNCTAD and over 10 years have passed since the issuance of the decrees on the national innovation system, a significant period of time in which to assess what works and what does not, yet the same policy framework and policies are in place. It may be time to radically revise the strategy and policy approach and adapt it to new circumstances. Policy continuity is always necessary to provide stability for stakeholders, yet the national innovation system lacks some modern policy instruments. For example, earlier policy documents anticipated close coordination between the Ministry of Economy and Planning and the Ministry of Industry and Commerce, but this does not appear to be taking place. The national innovation system appears to be restricted to the domain of the Ministry of Higher Education, Science, Technology and Innovation. A new national innovation system strategy may be developed, accompanied by an updated and upgraded set of policies and incentives, as well as a new coordination mechanism

4. Sectoral innovation systems: Manufacturing and agriculture

4.1 Evolution and status

4.1.1 Manufacturing

There have been five stages in the evolution of the manufacturing industry in Angola, of which the first three were as follows (table 14):

- Up to 1975, the period of manufacturing take-off, with sustained growth and industrial production mainly determined by Portugal, somewhat focused on the domestic market and benefits not reaped locally
- In 1975–1991, the period of centrally planned manufacturing, against the background of the civil war and characterized by significant shortages in inputs, energy and water, as well as human resources due to the significant exodus of technical personnel. Shortages were accompanied by the nationalization of factories, the salvage and dismantling of tools and equipment, the significant lack of maintenance, poor management and worker absenteeism. The difficult conditions in these years had a negative impact on manufacturing growth
- In 1991–2002, the period of manufacturing, in which the main focus was on addressing the accumulated challenges from the two previous stages, and of the operational environment, which led to the consideration that a centrally planned approach might not be feasible. Given the high level of military expenditure, only industries related to defence appear to have expanded in this period (Ferreira, 2006). Manufacturing grew by around 1 per cent on average over the period

Table 14
Angola: Average real gross domestic product growth by sector
(Percentage)

Period	Agriculture	Manufacturing	Services	Gross domestic product
1970–1975	2.38	2.35	2.36	2.38
1975–1991	-0.51	-3.47	0.19	0.84
1991–2002	-1.05	0.98	-0.64	1.59
2002–2012	10.5	13.5	10.97	10.4

Source: UNCTAD calculations, based on Wolf, 2017.

During the fourth stage, in 2002–2017, the period of manufacturing revival, the Government continued to play a central role in promoting manufacturing but the approach shifted from central planning to directing, through the establishment of priorities and the provision of incentives. At the centre of manufacturing promotion was the satisfaction of domestic consumption through export promotion and import substitution, to reduce balance of payments constraints, and the establishment of vertical and horizontal linkages and improvements in income distribution, to expand the local market, were also critical elements (Wolf, 2017). The Government articulated an industrial strategy through Reindustrialization Plan 2003–2007, which identified as priorities both labour-intensive (food processing, textiles) and capital-intensive (petroleum products, aluminium smelting, tobacco, fertilizers, plastics) industries, and National Industrialization Programme 2013–2017, which emphasized natural resource processing, foodstuffs, beverages, packaging, textiles, paper, rubber, electrical equipment and light metal industries (Golub and Prasad, 2016; Ovadia, 2018). The policy mix in this period included investment incentives through a private investment law, granting tax benefits of 5–100 per cent for 1–10 years on industrial,

property transfer and income tax, depending on location (Wolf, 2017). Tariffs were raised on locally produced items such as beverages, while machinery imports were exempt from import duties. The Government also constructed several industrial development parks in different regions and the Luanda-Bengo zone, which hosts several industrial firms. The sectoral orientation of industrial parks varied across regions but was generally aligned with industrial priorities. Financial support included improved access to credit through the Development Bank of Angola and the Bank for Savings and Credit, which provide finance for microenterprises and small and medium-sized enterprises. The Institute of Business Development and the National Institute for Support to Microenterprises and Small and Medium-sized Enterprises have provided technical, marketing-related and financial support for manufacturing firms. At the same time, skills improvement was achieved through the construction of vocational training centres and technical cooperation with Brazil, Israel, Portugal, the Republic of Korea and Spain. The manufacturing industry performed well during this stage, growing at 13.5 per cent in 2002–2012 and continuing to grow at high rates until 2016, except for in 2014, following sharp falls in oil prices and a banking crisis. As a result, the share of manufacturing increased to around 7 per cent of GDP by 2016, given the high rates of manufacturing output (table 15 and figure 22). Growing demand from China for oil from Angola helped ease balance of payments constraints and allowed for higher volumes of capital goods imports. At the same time, construction projects in China fuelled demand for local construction material, which supported the high growth rates in manufacturing; however, direct investment from China in manufacturing does not seem to have been an important driver of growth in this period compared with other foreign and domestic investment sources, particularly in the food and beverages industries (Wolf, 2017). This suggests some success with regard to policies enacted during this stage, although it is unclear whether there was a broad or narrow base of beneficiaries. However, it was difficult to sustain the rapid growth rates after 2016 in the wake of falling oil prices and the challenges in enlarging the local market due to high levels of income concentration, high levels of protection resulting in inefficient production and a public administration that was not entirely favourable to business (Golub and Prasad, 2016; Wolf, 2017).

Table 15

Angola: Gross domestic product and manufacturing output growth
(Percentage)

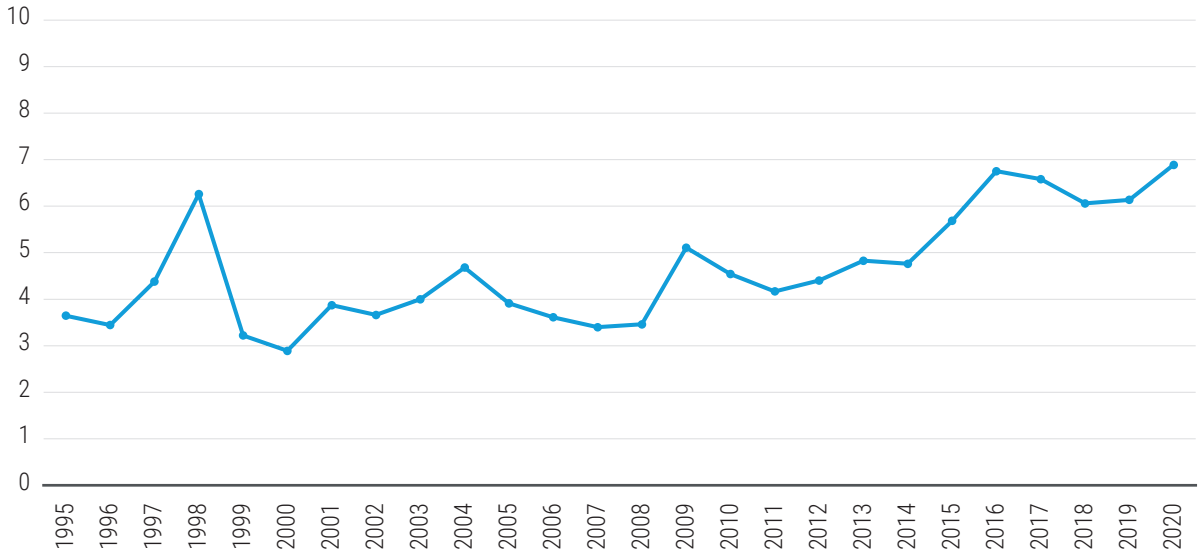
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Manufacturing output	6.8	9.6	9.1	9.6	7.7	-9.9	12.0	11.6	1.2	0.6	-5.1	11.8
Gross domestic product	0.9	4.9	3.5	8.5	5	4.8	0.9	-2.6	-0.2	-1.3	-0.7	-5.4

Source: UNCTAD calculations, based on National Institute for Statistics, 2019, and National Institute for Statistics, 2020.

During the fifth stage, beginning in around 2017, the period of manufacturing liberalization, the Government issued two industrial development plans, focusing on diversification through expanded foreign and domestic investment in manufacturing, improved knowledge and competencies and the use of local resources. To implement industrial development, the Government identified the following four areas of activity: improving the regulatory and institutional framework; expanding the qualifications of the workforce; expanding the industrial infrastructure, in particular industrial parks and special economic zones; and developing a more dynamic and innovative industrial structure. The Ministry of Industry and Commerce and the Production Support, Export Diversification and Import Substitution Programme are the leading government agencies and instruments in implementing industrial development plans. National Industrial Development Plan 2025 is aimed at increasing the share of manufacturing to 5 per cent of GDP by 2025. After an initial period of slow growth and retrenchment, manufacturing production began to recover its earlier fast growth rates, with a growth rate of 11.8 per cent in 2020. On 8 April 2022, the

Figure 22

Angola: Manufacturing value added as share of gross domestic product
(Percentage)

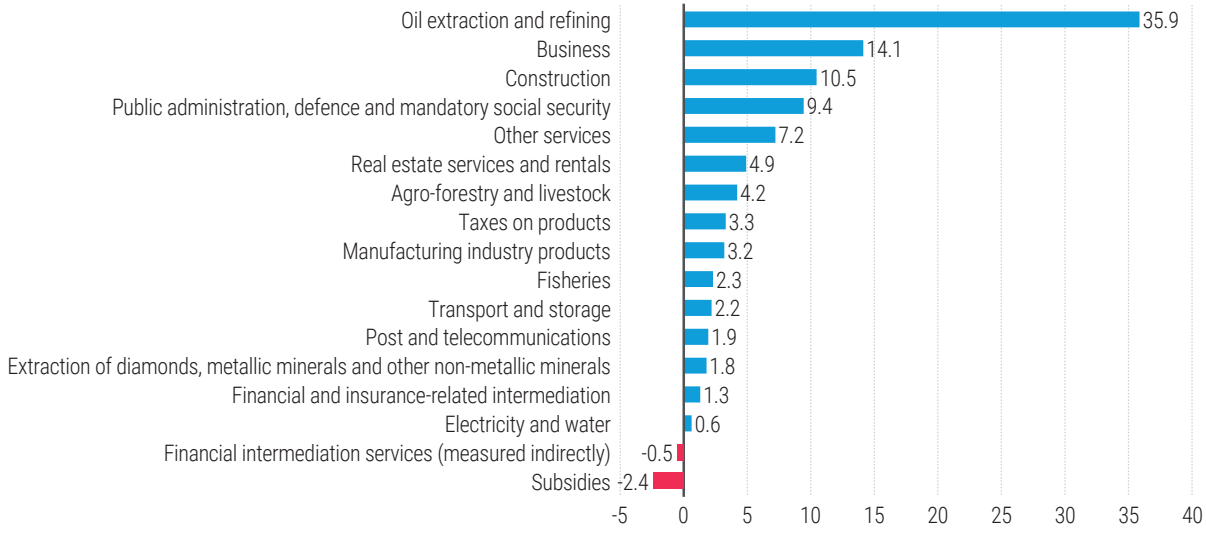


Source: UNCTAD calculations, based on data from the World Development Indicators database.

local business newspaper *Expansao* stated that manufacturing production had grown by a further 5.2 per cent in 2021. Despite this recent growth performance, manufacturing is estimated to represent only 3.2 per cent of GDP (figure 23). In addition, manufacturing remains concentrated in the food and beverages and oil derivatives and chemicals industries, which account for over 90 per cent of the total manufacturing industry. More intense diversification efforts therefore need to be undertaken in order to achieve government manufacturing objectives.

Figure 23

Angola: Share of activities in gross domestic product, 2021
(Percentage)



Source: UNCTAD calculations, based on National Institute for Statistics, 2021.

4.1.2 Agriculture

As noted, the agricultural sector was one of the sectors affected the most significantly by constraints in Angola, in particular, the abandonment of land and the displacement of populations to urban centres, particularly in 1991–2002; the destruction of or weakness in infrastructure, particularly roads; and the destruction of commercial networks. A summary of the main aspects of the agricultural sector are as follows:

- The sector has two models, namely, business farms; and family farms, subsistence farming and small farmers, in which most of the population is concentrated. The two models coexist and require State support for development and strengthening
- Before independence, Angola was one of the largest exporters in the world of bananas, cassava, coffee, corn, cotton and sisal, and also guaranteed domestic supply. The sector showed prospects for continued growth
- The sector contracted during the civil war, with an increased reliance on subsistence agriculture. Exports lessened and imports of food increased
- The economic growth due to the oil boom has not benefited the agricultural sector, which has not attracted investment interest
- The situation with regard to land is complex. Law 9/04 of 9 November 2014 states that land is property originating in the State and that the State may grant natural and legal persons the right of use. This condition may inhibit large investments, as well as the development of subsistence agriculture
- The National Institute for Cereals was established in 2013, aimed at ensuring the promotion, coordination and implementation of policies and strategies in the field of the production, import, export, marketing and industrial processing of cereals (Presidential Decree 225/13 of 26 December 2013)
- Implementation of Medium-Term Development Plan for the Agricultural Sector 2018–2022, mainly aimed at increasing domestic production and exporting surplus, is ongoing
- Integrated Plan for the Improvement of Family Farming and Fisheries 2020–2022 is aimed at mitigating the effects of the pandemic on the economy and investing in increasing productivity and national agricultural production, family forest products, fishing and aquaculture at the artisanal level oriented to the market, to ensure national food security

The agricultural sector is economically fragile, and the State should take steps towards its revitalization by investing in measures and programmes that can also later serve to attract FDI. However, analysis of the general State budget shows that amounts allocated to the sector have been greatly reduced (table 16). In 2007–2019, investment in the sector decreased significantly. Given other concerns related to knowledge, logistics and markets (Catholic University of Angola, Centre for Scientific Studies and Research, 2021), the lack of investment is of even greater concern, hindering the performance of the sector.

Table 16

Angola: Share of funds allocated under the general State budget to the agricultural sector

(Percentage)

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2.0	1.7	1.7	1	0.9	0.8	1	0.6	0.5	0.5	0.4	0.3	1.57

Source: Catholic University of Angola, Centre for Scientific Studies and Research, 2019.

A change that could initiate a paradigm shift began in 2018–2019, when the budget increased from 0.3 to 1.5 per cent, although it remained below the value in 2009. This is in line with efforts made since 2017–2018 to diversify the economy. The aims of the increased public investment in the agricultural sector are as follows:

- Increase the quantity and quality of food, particularly for domestic consumption, thereby combating hunger and poverty and some associated social ills such as crime; and export and acquire foreign exchange to invest in the sector and in other sectors, such as industry
- Recognize and valorize family farming, with an emphasis on the position of rural women, enhancing support to the rural population and empowering young people, thereby reducing unemployment and, consequently, the exodus to urban centres, and strengthening social networks and family bonds

Despite reductions in investment, the agricultural sector has grown since 2016 (table 17).

At the same time, there has been a downward trend in spending on food imports (table 18) and an increase in agricultural production (table 19).

Table 17
Angola: Growth rate of the agricultural sector (Percentage)

2016	1.77
2017	1.41
2018	2
2019	0.8
2020	4.4

Source: Catholic University of Angola, Centre for Scientific Studies and Research, 2021.

Table 18
Angola: Spending on food imports (Millions of dollars)

2017	3 257.6
2018	3 160.5
2019	2 613.2
2020	n/a
2021	1 361.0

Source: Catholic University of Angola, Centre for Scientific Studies and Research, 2021.

Table 19
Angola: Agricultural production (Tons)

	Production group			
Agricultural year	**Cereals**	**Roots and tubers**	**Legumes and oilseeds**	**Total**
2018/2019	2 902 643	11 135 827	574 954	14 613 424
2019/2020	3 071 085	11 823 262	606 698	15 501 045

Sources: Ministry of Agriculture and Fisheries, 2020; Ministry of Agriculture and Forestry, 2019.

4.2 Building new productive and technological capabilities in manufacturing and agriculture

Diversification efforts have been ongoing since the 2000s. Diversification into emerging manufacturing activities has been a high priority in Angola. The rationale for diversification is well understood and has been discussed in several international and domestic reports. The production and export of natural resources have contributed to growth in Angola, yet oil reserves are being depleted and could be exhausted by 2032, and the country has not efficiently converted natural resource revenue into productive capital, and has therefore not contributed to wealth and, in this regard, the diversification of exports could add 3.3 per cent to per capita GDP, increase total factor

productivity and help address export volatility due to unstable global prices or demand (World Bank, 2018). Reliance on oil exposes Angola to "Dutch disease", resulting in currency appreciation that crowds out other tradable goods sectors and to "resource curse" effects linked to corruption and rent-seeking; oil production is highly capital intensive, leading to few employment opportunities and minor spillovers to the rest of the economy (Golub and Prasad, 2016).

The Government re-emphasized the need for diversification by establishing the Production Support, Export Diversification and Import Substitution Programme, which introduced a range of entrepreneurship, financial and support measures, to encourage diversification. With regard to manufacturing development, the set of priorities under the Programme for spurring sectoral and manufacturing growth may be examined. The approach combines export promotion and import substitution industrialization strategies across the economy. In support of sectoral development, the Programme introduces several cross-sectoral measures. The aim is to create enough production capacity in key priority activities to gain scale and create intrasectoral and intersectoral relationships to establish productive clusters in several domains and industries (table 20).

Defining sectoral and industrial priorities is complex and involves establishing a strategy that envisions the position of a country within the next 10–20 years; conducting an analysis of productive and technological capacities and strengths and weaknesses; and adopting a risk-based perspective of upcoming political, economic, technological, demographic and social trends worldwide and how they might impact the local economy. The definition of priorities needs to be supported by the application of different prioritization approaches and methodologies and requires a solid understanding of the managerial and technical feasibility of related tasks. As with STI priorities, it is crucial to have, at least initially, a clear focus on a few activities that can act as triggers for dynamic and sustained economic growth, in particular, manufacturing activity.

In Angola, diversification has been limited to date. There appears to be a disparate set of labour-intensive and capital-intensive industry selected rather than a clear direction and set of priorities (Golub and Prasad, 2016). The present selection of industries is along similar lines, without an apparent methodology for their prioritization beyond mention of their potential for export and import substitution. The selection is broad and reflects many activities already in operation.

There are several methodologies for prioritizing industrial sectors. For example, the growth identification and facilitation approach developed by the World Bank is based on latent comparative advantage (Lin and Monga, 2010). Another methodology, developed by the United Nations Industrial Development Organization during the preparation of Industrial Strategy 2040 in Oman, combines the four industrial growth dimensions of production capacity, import substitution possibility, export potential and long-term dynamism of particular industries (Oman Ministry of Commerce and Industry and United Nations Industrial Development Organization, 2019). An economic complexity analysis, as discussed in the next section, is an alternative approach to identifying industries with potential for growth (Hausmann and Klinger, 2008; Hidalgo and Hausmann, 2009).

Table 20
Angola: Priority domains and industries

Agro-industry and fisheries
Industrialized agricultural and livestock crops that are part of the basic basket of goods: rice, sugar, beans, cornmeal and cassava flour, wheat flour, soy and palm oil, jerky
Legumes
Oilseeds
Fruit and vegetables
Tubers
Other agricultural products, particularly soybeans, cotton, sugar cane, moringa and palm trees
Eggs and chickens
Beef, goat and pork
Mineral resources and petroleum
Coke, refined products and fuel agglomerates
Ornamental rocks
Gold
Quartz
Minerals from the chemicals industry for the manufacture of fertilizers
Limestone and natural gypsum
Natural sands
Industry
Industrialized goods from the basic food basket, namely, pasta, bar soap and powdered milk
Beverages
Textile products and clothing items (medium-term perspective, with development of cotton production and gradual development of other inputs, such as trimmings)
Production of non-metallic minerals (cement, lime and gypsum, ceramic products, fibre cement products, marble and similar stone work)
Production of glass and glassware (e.g. glass packaging)
Production of base metals (iron and steel, ferroalloys, non-ferrous metals)
Wood and cork products (plywood, carpentry for construction, wooden packaging, basketwork, mats)
Basic pharmaceuticals and pharmaceutical preparations (including veterinary products)
Coffee
Bananas
Salt
Fishery and aquaculture products (e.g. crustaceans, molluscs, fish meal and oil)
Preparation and treatment of seeds of permanent crops and temporary crops for propagation
Products obtained from the recycling (recovery of waste) of paper, plastic and glass
Mineral or chemical fertilizers
Manufacture of pesticides and other agrochemicals
Industrial gases
Assembly of household appliances, peripheral equipment, agricultural tractors, motor vehicles and their components, motorcycles and bicycles
Hospitality and tourism
Accommodation and complementary means of accommodation
Restaurants
Travel agencies, tour operators and other related services

Source: UNCTAD, based on Ministry of Economy and Planning, 2018.

4.2.1 Identifying opportunities for economic diversification

The importance of targeting economic diversification to support national development is discussed in this section and results of an analysis to identify potential sectors for economic diversification in Angola are presented.

Economic diversification represents a shift towards a more varied production structure with an increase in the number of economic activities and job opportunities in an economy. Diversification includes the introduction of new products and an increase in the quality of existing products, and favours the possibilities for knowledge spillover within an economy. A successful process of economic diversification fosters the emergence of new economic activities, creating a virtuous cycle of endogenous growth based on the creation and exploitation of new business opportunities. The importance of economic diversification derives from the observation that economic growth is associated with a process of expansion of the range of goods and services in an economy, not simply with the increased production of the same commodities. Economic diversification is also associated with lower growth volatility and faster structural transformation. Research suggests that more diversified economies are more resilient to shocks and less vulnerable to volatility in the prices of exports. In addition, more diversified low-income countries have experienced greater reductions in the share of agriculture in GDP, the faster growth of aggregate labour productivity and greater contributions from intersectoral reallocation to aggregate productivity (International Monetary Fund, 2014). Efforts should be made to foster economic diversification, to generate increased employment and job opportunities in the formal economy in order for more people to be able to engage in jobs and productively contribute to growth and development. This requires the generation of employment and jobs that can utilize and capitalize on the creative energies of youth, thereby unlocking the potential of a country (box 4).

A strategy for economic diversification entails the prioritization of sectors and/or products, and the right sequencing of sector development may make economic constraints less binding (Foray et al., 2009; Lin et al., 2020). The application of the economic complexity framework to the economy of Angola allows for an identification of the sectors with greater potential under a successful transformative industrial policy. The results of the analysis do not constitute a receipt that should be directly applied to the economy but should be seen as the basis of an inclusive process of evaluating and selecting strategic options, leading to the design of dedicated interventions by the Government, for example in the framework of initiatives under the Production Support, Export Diversification and Import Substitution Programme and the Foundation for the Development of Science and Technology. The distinction is critical. The sectors and/or products with significant potential are presented in this section, but the definition of needs and implementation plans (e.g. with regard to infrastructure, investment schemes or knowledge development) should be tailored to the characteristics of the value chain of each sector. As such, the prioritization and design of interventions should involve different actors in the economy, from both the public and private sectors. Such an approach can help ensure a process that leverages the strength of the national innovation system and helps to identify areas in which targeted interventions are needed to solve existing bottlenecks.

Box 4

Understanding economic complexity

Economic complexity has become a reference framework through which to evaluate the stage of development of an economy. The measures developed under this framework allow for the evaluation of both a country's diversification and the ability to produce complex goods that can compete in international markets. Countries with higher levels of complexity have capabilities of producing a diverse portfolio of products, upgrading the economy into increasingly complex goods, showing more predictable (stable) long-term growth and having a competitive position relative to other countries.

A country's trade specialization profile reflects the underlying capabilities and skills that, when nurtured, can expand to meet new production requirements and lead to the adoption of new technologies. In international markets, factor endowments and their structures determine the possibilities for an economy and relative prices, which in turn determine the industries in the economy that will have comparative advantages. For this reason, complexity is evaluated using trade data rather than domestic production data, which may have distortions in factor allocation.

Since the 1970s, a few market economies, mostly in East Asia, have achieved substantial growth that has enabled a transition from low-income to middle-income or high-income economies. The process started after the1950s, when some economies in Asia adopted an export-oriented strategy based on manufacturing. By leveraging and refining capabilities, these countries sustained growth through comparative advantages, to upgrade industrially, diversify and increase competitiveness. Increases in competitiveness and the transition to an advanced economy were closely linked with the capacity to innovate and develop the economy towards more complex industries.

A country's economic complexity is evaluated, in general, with regard to the two measures of diversity and ubiquity. Diversity refers to the amount of knowledge embedded in an economy, expressed in its productive diversification, which increases possibilities for knowledge recombination. Ubiquity refers to the number of countries capable of making a product, whereby the higher the ubiquity, the lower the complexity. The production of complex products requires a high knowledge content and a large set of productive capacities, and only a low number of countries can master the knowledge required for their production.

The complexity approach can be seen as both a methodology for identifying sectors for economic diversification and as an approach to evaluating different projects or initiatives. On the one hand, it allows for predictions of the probability that a country will develop new competitive advantages starting from its existing production network; the process of diversification is more likely to be successful when countries try to develop in new related industries. On the other hand, it provides a theoretical framework for assessing the transformative potential of particular projects. For example, when evaluating different options, the assessment could include such questions as the following: Will an investment in petrochemicals or agribusiness unlock other more complex industries? Will the project unlock opportunities to upgrade to higher complexity products in the sector? Between two alternative sector-specific investments, which one is likely to create more opportunities?

Source: UNCTAD. See Hausmann and Hidalgo, 2011, Lin et al., 2020, and Van Dam and Frenken, 2020.

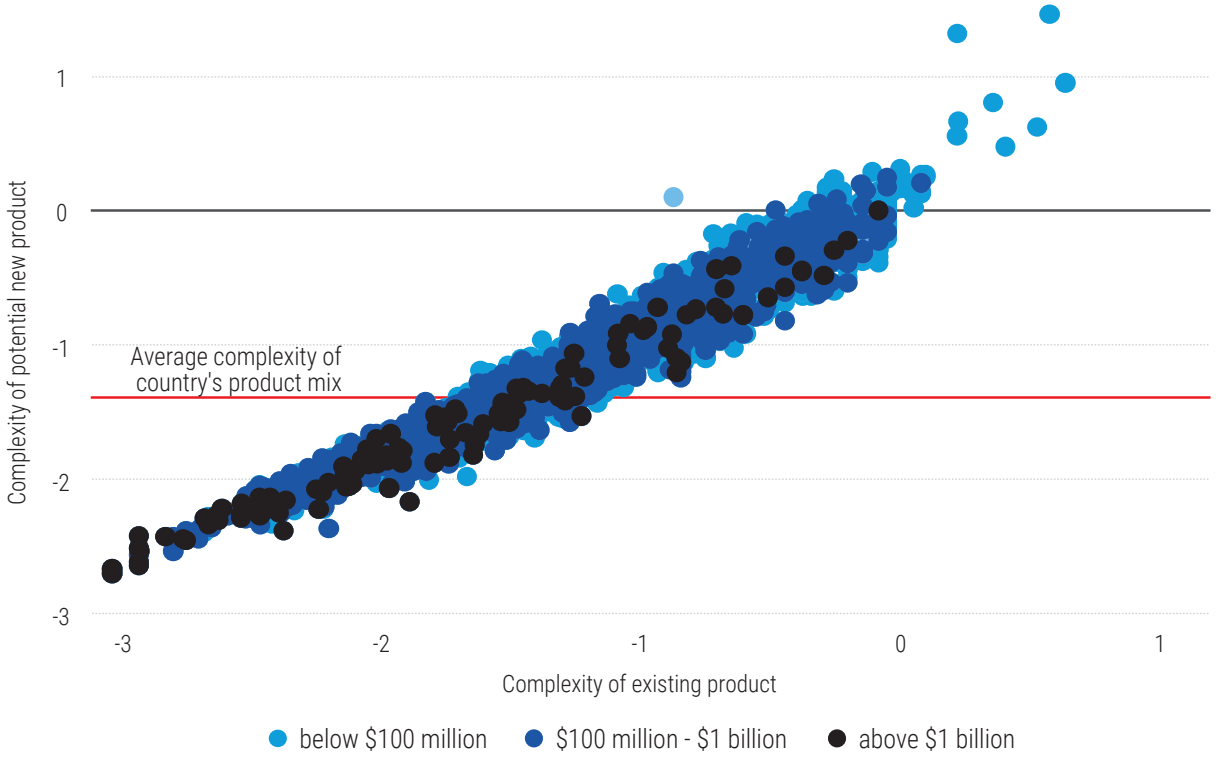
4.2.2 Product space

Diversification is path dependent, that is, the existing product mix in a country affects the new products that could emerge. This empirical regularity can be illustrated by mapping product space to show the likelihood of pairs of products being jointly exported (Hausmann and Klinger, 2008; Hidalgo et al., 2007). The type of question to be answered when constructing such a map is: "What is the probability that, in a country, firms could produce mobile telephones given that firms in that country produce garments?" The aim is to answer such questions for all possible pairs of products (with trade data used as a proxy for products), observe their association in the export baskets of all countries and derive the probability of successful diversification in the country with regard to a specific product on the basis of the existing export basket.

In Angola, opportunities with a greater probability of success in terms of economic diversification are with regard to products that are close to the existing product mix (figure 24).

Figure 24

Angola: Export opportunities for potential new products, 2019



Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: The scale is normalized; 0 = average global complexity and 1 = standard deviation of distribution of product complexity. Each circle indicates a potential new product, defined as a product exported by 85 per cent of the countries with the same export basket as Angola. The horizontal red line marks the average complexity of the country's product mix; new products with a complexity above this level would push distribution of the complexity of the product mix towards more complex products. Most potential new products for diversification are above the line, indicating that many products offer an opportunity to increase national productive capacities. Darker circles indicate products that are of below average complexity and, when considering potential exports, most of the more valuable opportunities in terms of market size are in these products. However, diversification towards these products leads to the risk of being trapped at a lower level of productive capacities.

Targeting more complex products is critical in national development. The analysis conducted, to identify potential sectors for economic diversification, with products that have a significant opportunity for export and involve above-average levels of complexity in their production, considers the increase in global imports in certain sectors in 2018–2019. Export opportunity is presented as the monetized annual increase in global imports. This does not imply that Angola would automatically tap the entire amount, as other countries that produce these goods would compete for the same expanding markets. For this reason, diversification opportunities are computed by referring to both the global economy (in which competition is greater) and the economy of Africa (in which a lower level of competition may be expected). In addition, to further cross check results, opportunity is also computed in terms of import substitution opportunities, which are measured by considering the products that are imported but not exported by Angola and that have a complexity above the national average. Given the high level of dependency on imports to satisfy internal demand, import replacement opportunities could drive the investment decisions of entrepreneurs and firms when considering investing in new production. The prospects for import replacement

for economic diversification in Angola are therefore high. In summary sectors and/or products for potential diversification are identified on the basis of:

- Export opportunities, considering all countries as possible destination markets
- Export opportunities, considering countries in Africa as possible destination markets
- Opportunities for import substitution

4.2.3 Identifying opportunities in the manufacturing sector

The potential new sectors for diversification of the manufacturing industry in Angola, with the greatest opportunities with regard to global export markets, export markets in Africa and import substitution, are shown in table 21.

Table 21
Sectors for manufacturing diversification with high levels of opportunity
(Percentage)

Global markets	African markets	Import substitution
Machinery and mechanical appliances (11)	Machinery and mechanical appliances (12)	Plastics and articles thereof (12)
Pharmaceutical products (8)	Plastics and articles thereof (8)	Machinery and mechanical appliances (10)
Plastics and articles thereof (8)	Iron and steel (8)	Iron and steel (8)
Electrical and electronic equipment (7)	Articles of iron or steel (7)	Aircraft, spacecraft and parts (7)
Organic chemicals (6)	Electrical and electronic equipment (6)	Articles of iron or steel (6)
Iron and steel (6)	Vehicles other than railway and tramway vehicles (6)	Organic chemicals (5)
Optical, photographical, technical, medical and other apparatus (5)		Pharmaceutical products (5)
		Aluminium and articles thereof (5)

Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: The numbers in parentheses are the shares of export and/or import opportunities in terms of the reference market. Products with a potential share at least equal to 3 per cent are included.

Several products and/or sectors rank among those with the greatest opportunities under each of the three approaches. With regard to sectors that rank high in terms of both imports and exports, export-led diversification could also meet domestic demand. Machinery and mechanical appliances and plastics and articles thereof rank among the leading sectors in terms of diversification potential under each of the three approaches. These products offer significant opportunities from the point of view of potential for both exports and import substitution. The plastics sector has close linkages with national endowments, namely, with regard to oil resources. Potential new products in the machinery and mechanical appliances sector include lifts and skip hoists, parts of steam or vapour generating boilers and filtering and/or purifying machines. Potential new products in the plastics and articles thereof sector include polyethylene, polyvinyl chloride and acrylic polymers.

Other sectors, such as pharmaceutical products and organic chemicals, offer significant opportunities for import substitution and export to global markets but are not among the leading sectors with regard to export to other countries in Africa.

Some sectors offer opportunities under only one of the approaches, as follows: Optical, photographical, technical, medical and other apparatus, global markets; vehicles other than railway and tramway vehicles, African markets; aluminium and articles thereof, import substitution. The prioritization of these sectors compared with the other sectors in the analysis should be carefully considered, as it would offer a narrow set of opportunities compared with the other sectors.

With regard to markets for potential new manufacturing products from Angola, the greatest export opportunities are, in global markets, in the United States, and in African markets, in Egypt (table 22).

Table 22

Export markets with significant potential for new manufacturing products from Angola, 2019
(Percentage)

Global markets	African markets
United States (12)	Egypt (26)
China (8)	Nigeria (12)
Germany (7)	Morocco (10)
France (6)	South Africa (8)
	Tunisia (5)

Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: Countries with a potential share at least equal to 3 per cent are included.

4.2.4 Identifying opportunities in agriculture and agribusiness

Given the large share of agriculture in employment in Angola, it is important to consider the opportunities for diversification that have backward linkages with the existing agricultural sector. New agribusiness sectors could increase demand for agricultural produce and create incentives for increasing productivity in the sector. There are mainly two strategies for promoting increased agricultural productivity, namely, labour push and labour pull.

The labour push strategy refers to improvements in agricultural technology that reduce the need for labour but increase the incomes of agricultural workers and their demand for manufactured goods, which, in turn, increases demand for labour in manufacturing, absorbing surplus labour in agriculture and further increasing agricultural productivity. The strategy may be traced to the classic four-stages theory presented by Adam Smith and Anne Robert Jacques Turgot in the eighteenth century and the proposal by WW Rostow in the 1960s that increases in agricultural productivity are a necessary condition for economic take-off.

The labour pull strategy refers to the expansion of manufacturing, which pulls labour into the sector and reduces a labour surplus in agriculture that, if sustained, eventually triggers increases in agricultural productivity. Examples of models include the dual-sector model of Arthur Lewis presented in the 1950s and the two-sector model of John R Harris and Michael P Todaro presented in the 1970s. Empirical evidence suggests that the pull strategy has been more relevant for countries in early stages of structural transformation when the share of employment in agriculture is above 40 per cent (Alvarez-Cuadrado and Poschke, 2011). This is of relevance in Angola, as the proportion of workers engaged in agriculture is above the suggested threshold of 40 per cent and has a low level of productivity. Policies that facilitate the emergence of productive economic activities in dynamic industries and services that use agricultural products as inputs, and at the same time raise productivity in both agriculture and manufacturing, combine the benefits of the push and pull strategies and have the potential to create a virtuous cycle.

The potential new sectors for diversification of the agriculture and agribusiness sectors in Angola, with the greatest opportunities with regard to global export markets, export markets in Africa and import substitution, are shown in table 23.

Table 23

Sectors for agriculture and agribusiness diversification with high levels of opportunity
(Percentage)

Global markets	African markets	Import substitution
Dairy products, eggs, honey, edible animal products not elsewhere specified (15)	Cereals (49)	Meat and edible meat offal (19)
Edible fruit, nuts, peel of citrus fruit, melons (15)	Dairy products, eggs, honey, edible animal products not elsewhere specified (24)	Beverages, spirits and vinegar (18)
Cereals (13)	Vegetable, fruit, nut, etc. food preparations (4)	Cereals (17)
Beverages, spirits and vinegar (9)	Oilseeds, oleagic fruits, grains, seeds, fruit, etc. not elsewhere specified (3)	Dairy products, eggs, honey, edible animal products not elsewhere specified (14)
Meat and edible meat offal (7)	Cereal, flour, starch, milk preparations and products (3)	Cereal, flour, starch, milk preparations and products (13)
Cereal, flour, starch, milk preparations and products (7)	Beverages, spirits and vinegar (3)	Miscellaneous edible preparations (6)
Vegetable, fruit, nut, etc. food preparations (7)		Vegetable, fruit, nut, etc. food preparations (5)
Animal, vegetable fats and oils and their cleavage products (5)		Animal, vegetable fats and oils and their cleavage products (3)
Oilseeds, oleagic fruits, grains, seeds, fruit, etc. not elsewhere specified (4)		
Meat, fish and seafood food preparations not elsewhere specified (4)		

Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: The numbers in parentheses are the shares of export and/or import opportunities in terms of the reference market. Products with a potential share at least equal to 3 per cent are included.

Several products and/or sectors rank among those with the greatest opportunities under each of the three approaches. In particular, all sectors with potential significant opportunities in African markets also rank high with regard to global markets and import substitution. The only exception is with regard to the oilseeds, oleagic fruits, grains, seeds and fruit sector. The main difference between the rankings is the significant export potential to African markets of cereals (49 per cent) and of dairy products, eggs, honey and edible animal products (24 per cent), which compresses the shares of other products and/or sectors.

Some potential new products in the cereals sector are wheat and barley and in the dairy products sector are whole milk powder and cream and processed cheese. Opportunities in global markets appear to be spread across a wider range of products. Sectors that could have a link with livestock production in Angola account for 27 per cent of global opportunities (dairy products (15 per cent), meat and edible meat offal (7 per cent), animal, vegetable fats and oils and their cleavage products (5 per cent)) and for about 36 per cent of import substitution opportunities (meat and edible meat

offal (19 per cent), dairy products (14 per cent), animal, vegetable fats and oils and their cleavage products (3 per cent)).

With regard to markets for potential new agricultural and agribusiness products from Angola, the greatest export opportunities are, in global markets, in China, and in African markets, in Morocco (table 24). China, Germany and the United States are also among the leading destinations for manufacturing products.

Table 24

Export markets with significant potential for new agricultural and agribusiness products from Angola, 2019
(Percentage)

Global markets	African markets
China (13)	Morocco (18)
United States (10)	Egypt (16)
Germany (8)	Ethiopia (12)
United Kingdom (7)	Tunisia (9)
	Mozambique (8)
	South Africa (7)
	Nigeria (7)

Source: UNCTAD calculations, based on Freire, 2017, and data from the United Nations Comtrade database.
Note: Countries with a potential share at least equal to 3 per cent are included.

4.2.5 Comparing the priorities of the Production Support, Export Diversification and Import Substitution Programme

Although there are differences in classification, some conclusions may be drawn. There is clear potential in the manufacturing industry for diversification into the production and export of cereals, meat, poultry, dairy products, beverages, animal and seed oils, sugar and cocoa products. Most of these coincide with priorities under the Production Support, Export Diversification and Import Substitution Programme. There is also coincidence in the potential for import substitution in the iron and steel industry and pharmaceuticals. There is no coincidence between the complexity analysis and Programme priorities in textiles, non-metallic minerals, glass and glassware, wood and cork products, most chemical products and assembly industries. All of these industries are necessary in the long term and inputs may be locally available yet the key question is whether productive capacities are already available and a thorough analysis of priorities is required to answer the question. With regard to Programme priorities, industrialization should be understood as a process that builds on past achievements; knowledge is cumulative and requires time and considerable effort. The more diversified an economy, the broader and deeper the knowledge base and productive capacities need to be. This is not always the case in countries at lower income levels. Thus, as with building technological capacity, creating productive capacities requires a focus on a few industries that can act as triggers or drivers of new activities, which can then create spillovers into other industries. Leapfrogging into new areas is possible with well-defined strategies but also needs to be limited at first to a few new activities in order to be able to benefit from the learning processes that necessarily accompany the establishment of new activities. In this regard as well, a well-considered and systematically worked out set of priorities would assist feasible diversification in Angola into new areas.

4.2.6 Recommendations

Economic diversification can play an important role in development in Angola by helping to reduce growth and export volatility and accelerate structural transformation, leading to job creation

and the shift of employment from lower-productivity to higher-productivity (and formal) sectors. Diversification experiences in countries with endowments similar to those in Angola that have transformed productive structures in recent decades show the need for an active role by the State in facilitating the movement of the economy from a lower to a higher level of development. The market also plays a central role in resource allocation and there is a need for the State to play a facilitating role, to assist firms in the process of industrial upgrading by addressing externalities and coordination issues. Based on the analysis, the following findings and policy recommendations are highlighted:

- The sectors of machinery and mechanical appliances, plastics and articles thereof, iron and steel and pharmaceutical products are among the sectors with the greatest opportunities for export to global markets. The first three also lead the list of sectors with opportunities for export to African markets
- Pharmaceutical products and organic chemicals offer significant opportunities for import substitution and export to global markets but are not among the leading sectors with regard to export to African markets. Both are associated with a strong cluster of scientific publications, indicating potentially successful industry–research partnerships
- The development of agriculture and increase of agricultural productivity should play a greater role in economic diversification. The suggested strategy is to consider agricultural development in an integrated manner that is mindful of agricultural and agribusiness linkages and the need to promote the structural transformation of the economy. The strategy should include the promotion of diversification into agribusiness that uses existing agricultural produce as inputs and that targets export markets
- Most of the sectors with significant potential for export to African markets also rank high with regard to global markets and import substitution. Cereals and livestock-related products appear to be the most promising agribusiness categories for diversification

4.3 Building dynamic and innovative enterprises in manufacturing

The enterprise structure in Angola is fragmented (Government of Angola, 2021). In 2018, the number of registered companies was 185,897, of which 52,689 were active and 130,858 had not yet started operations (National Institute for Statistics, 2019). Nearly 59 per cent of active firms were in Luanda, and most firms were family or private limited companies, with a roughly equal division between the two. Almost half of active firms were in wholesaling and retailing and 2,873, or 5.5 per cent of active firms, were involved in manufacturing (National Institute for Statistics, 2019). In comparison, according to data from the United Nations Industrial Development Organization statistics database, in 2018, there were nearly 50,000 industrial establishments in South Africa. Registration does not involve formality, yet most registered firms appear to be in the formal sector. Formal firms have employment contracts, pay the statutory minimum wage, protect employees against unfair dismissal and have social protection through governmental health, unemployment and pension schemes. As in many developing countries, most economic activity in Angola is in the informal sector. Informal firms engage in low-productivity subsistence farming, small coastal fishing operations, small-scale production and repair and the sale of handicrafts, as well as service industries such as retail, security and domestic work.

The employment distribution of manufacturing firms provides additional indications of the fragmentation of the firm structure (Government of Angola, 2021). Almost 63 per cent of active companies have 1–9 employees and most employ one or two people apart from the owner; 437 have 10–19 employees; and only 632 have over 20 employees. In terms of size, over 90 per cent of companies in the sector are microenterprises (1,805) and small enterprises (810), with 219 medium-sized and 39 large enterprises (National Institute for Statistics, 2019;

a definition of small and medium-sized enterprises is not provided in the data set). Law 30/11 of 13 September 2012 on microenterprises and small and medium-sized enterprises states as follows: microenterprises have a maximum of 10 employees and/or a gross annual turnover not exceeding $250,000; small enterprises have 10–100 employees and/ or a gross annual turnover of $250,000–$3 million; and medium-sized enterprises have 100–200 employees and/or a gross annual turnover of $3 million–$10 million. The size distribution of firms may not fully reflect the concentration of economic activity in particular enterprises. Often, individual firms are part of larger economic groups, in which public enterprises, individual shareholders, particular families or closely related partners own several firms, in closely related or widely diverse sectors. Membership in such groups yields significant economic power for the individuals and firms involved. Such groups can contribute significantly to industrial growth, as for example the chaebol in the Republic of Korea, yet they also serve to generate inequalities.

The long-standing support for small and medium-sized enterprises by the Government has been boosted through Presidential Decree 94/21 of 19 April 2021, which regulates activities and provides support to such firms. The decree excludes small and medium-sized enterprises that are members of economic groups and those in the financial sector, yet eases the process for the registration and establishment of enterprises and allows for simplified company accounting mechanisms. The legislation supports the resolution of bureaucratic constraints, differentiated treatment by State inspection services, labour relations, public purchases (public tenders must reserve at least 25 per cent of the execution of public contracts for small and medium-sized enterprises), favourable tax treatment depending on region and access to credit. Access to credit by small and medium-sized enterprises was already increasing; credit to microenterprises, which was negligible in 2019, had risen to 4.35 per cent of total credit by 2020 (Government of Angola, 2021).

Upgrading small and medium-sized enterprises technologically, particularly in manufacturing, remains a significant challenge to be faced by the Government. Making the legal, regulatory and institutional framework more friendly to small and medium-sized enterprises will assist formalization and allow such enterprises to access better human capital, knowledge and finance. However, informality is, above all, a survival option for companies that face acute levels of poverty, changing production structures and economic restructuring processes, the lack of absorption capacity in productive sectors and growing demands for flexible work processes. A push for formalization should therefore be accompanied by rapid growth and structural transformation policies.

To boost manufacturing in Angola, an enterprise structure that includes not only more manufacturing firms but also all sizes of firms is required. As with entrepreneurship, a differentiated policy support approach is needed. Manufacturing firms are more capital-intensive and knowledge-intensive, are more technologically demanding, require proportionally more semi-skilled and skilled employees and have medium-term investment horizons of 5–10 years. The expansion of technological and innovation capacity in Angola requires an integrated industrial policy package that supports diversification into manufacturing.

4.3.1 Investment

A key policy area is investment attraction into selected manufacturing industries. Investment promotion has been at the centre of the national diversification policy in recent years. In 2018, the Government merged several agencies and established the Private Investment and Export Promotion Agency, which is responsible for all aspects of private investment, export promotion and international business partnerships. The establishment of the agency was followed by two investment promotion laws (2018, 2021) and one competition law (2018), which frame the benefits for investors regardless of origin. Private investment laws allow for any level of investment, eliminate the obligation of local partnership, guarantee the transfer of profits and dividends abroad, exempt certain types of priority projects from the payment of duties and dues for five years and grant automatic tax benefits. In addition, the laws provide tax advantages for all new investments and

distinguish between the non-priority regime and priority-activity regime and provide differentiated real estate, industrial and/or income, capital gain and stamp duty rates depending on the regime, with further advantages within special regimes depending on location. The major change in the revised law in 2021 was the introduction of a third regime, the contractual system, which operates through a negotiation process regarding the conditions for implementing a project and the incentives and facilities to be granted concerning a private investment contract in any sector. The approval process and the transfer of profits and dividends abroad were also further eased.

In August 2018–February 2022, the Private Investment and Export Promotion Agency registered 444 investment projects amounting to $4.8 billion (Government of Angola, Private Investment and Export Promotion Agency, 2022). Nearly half of the investment is directed to manufacturing, mainly in the oil industry. There are 119 completed projects amounting to $1.2 billion. The largest investors are China, France, Germany, the United Arab Emirates and the United Kingdom; about one quarter of total investment is of mixed origin. According to UNCTAD (2019), Angola has underperformed compared with other countries in the region in attracting FDI.

The Government began to pursue structural reforms in 2020, to assure investors of a transparent environment for investment, but this environment remains a challenge for foreign investors, particularly with regard to the local content regime (limits on expatriate labour), excessive bureaucracy, difficulties in transferring payments abroad, levels of corruption and impunity and some infrastructure limitations, in particular continuing power outages (Embassy of the United States, Angola, 2021).

4.3.1.1 Recommendations

From a manufacturing perspective, addressing energy limitations by reducing or eliminating power outages and increasing electricity supply is key to sustained investment in the sector. A more targeted approach to attracting investment is critical to development of the sector. Existing incentives are generous; the next step could be to identify a few (4–5) high-impact manufacturing projects and seek investors, both locally and abroad. It is not necessary to prepare sophisticated feasibility studies but only to identify possible areas for investment and create teams that can find potential investors, approach them and develop a negotiation and incentives strategy. The revised investment promotion law, by introducing the contractual system approach, already provides a legal framework in this regard and the next step could be the formation of the search and implementation teams. Because of the specialized skills required in manufacturing, at least temporarily, significant flexibility in allowing for expatriate labour under the targeted projects will be a key incentive in attracting foreign investors. Countries that have successfully attracted large manufacturing investors, such as Costa Rica and Ireland, have used this targeted approach. However, a cautious approach should also be taken, as flexibility and discretion in negotiations could lead to corruption, which could be damaging to the attraction of investors in the long term; both the individuals involved in negotiating teams and the procedures adopted should therefore be carefully selected.

4.3.2 Special economic zones

Angola is attempting to attract FDI and promote the diversification of economic activity by establishing special economic zones and free trade zones and providing them with various conditions and incentives. Exclusive economic zones emerged as public development companies independent from the central administration and provided investors with a simplified administration and the necessary infrastructure, including in terms of energy, water, sewage, roads and amenities, as well as extraterritoriality in terms of taxation and finance. The zones usually include special economic zones, industrial development zones and rural industrial parks, and incentives are allocated based on regional priorities, with some directed to less developed regions (see Alcorta and Tesfachew, 2020). Zones are reserved for manufacturing, agribusiness and commerce activities.

At end-2019, there was one operational special economic zone in Luanda-Bengo and there were two operational industrial development zones in Viana and Catumbela (UNCTAD, 2019). The former was created in 2009 and has water, electricity, telecommunications and road infrastructure, is close to the airport, has business facilitation services and has a differentiated labour regime. Tenants pay rental fees for use of the zone. By end-2021, the zone had created 6,132 jobs for Angolans. Projects include the manufacturing of foodstuffs and other products, a thermoelectric power station and electrical devices, steelmaking, manufacture of building materials and automobile inspection centres, with 130 industrial and commercial projects, of which 75 are fully operational and 60 per cent are factories (Zawya, 2021).

Special economic zones in Africa have not shown the dynamism expected, have not achieved socioeconomic goals and are underperforming compared with comparator zones in Asia and Latin America (Farole, 2011). There is much scope for growth in the economic zones in Angola. According to UNCTAD (2019) two difficulties hinder the use by investors of special economic zones, as follows: the zones operate with autonomy, yet the current legal set-up for access to land involves different government institutions depending on the purpose of use and origin of the investor, leading to coordination failures and the lack of information-sharing between agencies, compounded by outdated cadasters based on historical records and the limited technical and financial capacity of local administrators; and the project identification and selection of authorities of the zones, along with the project monitoring and evaluation mechanisms in place, have not been optimal, resulting in underutilization of the zones.

Law 35/20 of 12 October 2020 established new free trade zones to replace previous zones and combine the features of industrial parks, special economic zones and free trade zones (Alcorta and Tesfachew, 2020). All types of investment, whether domestic or foreign, are permitted, and the focus is on agriculture, technology and industry (using raw materials from Angola and aimed at export). Investors can benefit from the free trade zones for up to 25 years, renewable for up to another 25 years. Benefits include exemptions from and reductions of rates and taxes; free capital repatriation, including capital gains, dividends and profits and royalties; exemptions from labour laws; and priority access to services and simplified processes to obtain licences and authorizations. There is an obligation to hire local labour, but skilled expatriates are allowed if the numbers do not exceed the number of local employees. The benefits to be granted to an investor are determined in the investment contract. Law 8/22 of 14 April 2022 reduces income tax on exports, exempts capital gains profits from taxes, reduces taxes on royalties and interest payments and eliminates property taxes inside the free trade zones.

4.3.2.1 Recommendations

- Taxes and other benefits are only one aspect that investors consider and may not be the most important. Angola should first address any issues of lack of coordination and information, and build technical and managerial capacities among the staff involved in free trade zones. A purpose-built high-level task force with the power to identify problems and suggest solutions needs to be established as soon as possible to maintain the momentum created by the new law. The task force should also investigate the staffing, payment and training of staff in the zones and identify and implement best practices in the organization and management of the zones. A proposal to enlarge the zones for agricultural purposes by using new or adjacent land in agreement with existing communities could also be explored (UNCTAD, 2019). Finally, the task force should be able to make proposals for complementary legislation clarifying or improving aspects of the law, in particular the extent to which activities in the zones are aimed at the domestic market
- The development areas in Angola are as follows: zone A, Luanda Province, capital municipalities of Benguela and Huíla Provinces and Lobito municipality; zone B, Bié, Bengo, Huambo, Cuanza Norte, Cuanza Sul, Namibe Provinces and other municipalities of Benguela and Huíla

Provinces; zone C, Cunene, Cuando Cubango, Lunda Norte, Lunda Sul, Malanje, Moxico, Uíge and Zaire Provinces; and zone D, Cabinda Province. The Luanda-Bengo zone is well supplied with infrastructure but other zones are not. To promote regional development and make free trade zones beyond the capital more attractive, a necessary first step is to improve infrastructure and investment facilitation in different regions (UNCTAD, 2019). Angola should also consider new trends in economic zones and consider including ecopark features in free trade zones (Alcorta and Tesfachew, 2020). Ecoparks aim to ensure sustainability by integrating social, economic and environmental quality aspects into the planning, operations and management of economic zones

- The development of free trade zones should be connected to government investment and diversification priorities. Investment targeting should be used, at least initially, to locate activities in free trade zones, particularly export-oriented projects. It is critical for the number and size of projects in zones to grow rapidly, to provide an impetus for reaping agglomeration economies, generating spillovers and attracting further entrepreneurs and skilled employees. A primary objective at this stage of the development of a free trade zone should be fostering networks and interenterprise cooperation, to establish clusters of economic activity in priority areas. The government and the management of free trade zones could promote information-sharing and corporate engagement, directly or through brokers such as industry associations or chambers of commerce (Alcorta and Tesfachew, 2020)
- Another major objective of free trade zones should be to engage in global value chains, which will increasingly require a more skilled labour force as such chains progress technologically. The involvement of cheap labour in global value chains from Angola does not appear feasible given the “Dutch disease” factors observed in the economy of Angola. To increase the supply of skilled employees it is important to balance worker rights and benefits and labour market flexibility in such a way that a significant gap is not created between domestic labour legislation and the labour regime in a free trade zone, to avoid reducing protection standards in the free trade zone (UNCTAD, 2019). Free trade zones should ensure a supply of labour with the qualifications demanded by investors, as this could be a major inducement to the involvement of investors. Training could be provided based on the requirements of a zone, either directly or through industry associations or chambers of commerce

4.3.3 Local content and supplier development programmes

Local content rules are not always favoured by foreign investors but, when well implemented, are a proven mechanism for creating local productive and technological capabilities and domestic industry (Weiss, 2016). Angola has a complex set of local content rules in the oil and gas sector. The petroleum activities law (2003) required Sonangol and its partners to acquire materials, equipment, machinery and consumer goods produced in Angola (Embassy of the United States, Angola, 2021). The law stipulated that preference must be given to local companies even if the price was up to 10 per cent higher than that of competitive foreign goods and there were three “angolanization” levels for the hiring of services, namely, reserved for Angolan companies, open to joint ventures and freely provided by foreign service providers. Goods were considered locally produced if they had 60 per cent of local value added and services were considered locally produced if they had 40 per cent of local value added; and with regard to employment, a rule of 70 per cent national and 30 per cent foreign was introduced. The local content law was modified in 2020, with the following two types of firms defined in addition to foreign firms: 100 per cent Angolan-owned; and companies incorporated in Angola, without reference to ownership. If a 100 per cent Angolan-owned company can provide a local product, preference will always be given to the company in contracts. With regard to services, the following three supply regimes were introduced: exclusivity, only for 100 per cent Angolan-owned firms; preference, only for 100 per cent Angolan-owned and Angolan-incorporated firms; and competitive, for any firm, whether domestic or foreign. Oil companies and concessionaires must prepare and submit to the

Ministry of Mineral Resources, Petroleum and Gas lists of the goods and services to be covered under the exclusivity and preference regimes for approval and disclose them to the public, and must also prepare a human resources plan indicating how the angolanization of personnel will proceed and an annual local content plan with forecasts of demand for goods and services and how they will be localized.

It is unclear how effective the local content regulations have been in developing the local manufacturing industry. Local content regulations have guidelines that are loosely or rarely enforced, making it easy for companies to comply with them (Embassy of the United States, Angola, 2021). However, companies lack clarity on how to follow the regulations, which introduces uncertainty, as local content criteria are sometimes included in government decisions for public tenders.

4.3.3.1 Recommendations

Making local content rules more transparent and introducing operative regulations could serve as the start of a joint public–private partnership for ensuring that such rules have a greater impact. To the extent that local suppliers can provide goods and services at the standard required and at prices competitive with those of imports, it is in the interest of buyers to have a regular local supply, as delivery times can be shorter, maintenance and repair can be quicker and the inevitable adaptations needed due to differences in local conditions can be more easily addressed. A stepwise approach involving the private sector in addressing existing challenges may be the most apt, as governments can face implementation difficulties. In this context, existing rules should be expanded with local content targets and the targets complemented by a supplier development programme. Local content targets are necessary to guide the process of upgrading. Supplier development programmes involve larger firms helping to upgrade supplier firms, usually small and medium-sized enterprises, through training, mentoring and technical assistance and by working together on particular projects. Together, local content targets and supplier development programmes are applied in many industries and countries and are one of the main tools with which to develop local industry (Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 2018; Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development, 2019). Companies also have supplier development programmes to improve the capabilities of their suppliers.

Given implementation difficulties in Angola, undertaking a pilot approach may be recommended.

First, rather than the usual share of local content for industry, a 1–2 per cent increase in value added per year by the firms involved should be fixed. The supplier development programme should first focus on the oil and gas industry, in which there is some experience with such approaches, initially involving only Sonangol and two major concessionaires, each upgrading around 20–25 manufacturing suppliers. The Ministry of Mineral Resources, Petroleum and Gas and the Ministry of Industry and Commerce should be responsible for running the pilot project and, together with Sonangol, identifying and reaching an agreement with other concessionaires, to engage in the project, which would run for 2–3 years. The expected increase in value added, to be set during negotiations, will derive from purchases of local raw materials, inputs and machinery. Sonangol and concessionaires should conduct a gap analysis in collaboration with the Ministry of Mineral Resources, Petroleum and Gas, to understand the differences between the products being offered by local companies, particularly (but not exclusively) small and medium-sized enterprises, and the requirements of purchasers with regard to price, design, volume, quantity and sales services. Companies that can close the gap should be approached or included in the supplier development programme.

Second, once the pilot project has been completed, the scheme could be rolled over to a few other firms and extended for 2–3 years, then again a few years later, until the largest 30 firms in the oil and gas industry have been reached. To encourage companies to engage in the scheme and the gap analysis, any loss incurred due to the scheme could be double-tax deductible for up

to three years. The scheme should be evaluated after 5 and 10 years of operation. The supplier development programme can run in parallel with the local content scheme and feed into it. The aim is to improve supplier performance. The starting point for the supplier development programme should be a survey that targets as many manufacturing suppliers as possible to ascertain overall capacity to supply firms with higher-level demands and should target suppliers of existing companies and advanced small and medium-sized enterprises. The survey could serve as the starting point for the gap analysis.

Third, as improvements are made and lessons learned, the scheme can be expanded into manufacturing, wholesaling and retailing, involving the largest firms in each sector. Targets can be set for large commercial firms, such as supermarkets, for the allocation of shelf space (e.g. 10 per cent) for local agricultural and manufacturing products. The scheme could be tested for three years in agreement with key retailers and supported by a supplier development programme created for this purpose. Successful programmes can have significant upgrading impacts on the quality of local entrepreneurship.

4.3.4 Public procurement policies and "buy Angolan" campaigns

In 2010, the Government introduced a procurement management framework that prioritized Angolan businesses, whereby goods and services produced by Angolan firms or Angola-based suppliers had to be preferred in local procurement procedures if their prices did not exceed 10 per cent of the price offered by competitors. The framework introduced a public procurement authority and established thresholds for different types of procurement. The framework was subsequently modified through two public procurement laws (Law 9/16 of 16 June 2016 and Law 41/20 of 23 December 2020), which have gradually increased the scope of procurement operations covered by the laws and at present include most government activities; operations that are excluded have been clarified. The latest law defines the criteria for evaluating bids, including quality, after-sales service and technical assistance, environmental and social sustainability and the number of jobs created. Angola is not a party to the Agreement on Government Procurement of the World Trade Organization, providing significant autonomy to modify national procurement regulations. Despite continuous improvement, the content and impact of the procurement regulatory framework may need to be addressed. Procurement laws and regulations are unclear, little publicized and not consistently enforced; audits are not required or performed and oversight mechanisms are weak, meaning that it is not possible to know whether internal controls are in place and administrative procedures are followed; and the bureaucracy implementing many procurement contracts is ineffective, leading to long payment delays for the goods and services delivered (Embassy of the United States, Angola, 2021). Changes to procurement laws have focused on addressing some of the issues raised by commentators, by simplifying procedures; still, despite the stated aims, they have yet to be used as a mechanism to develop local productive capacities and serve as a technology and industrial development policy instrument.

4.3.4.1 Recommendations

- Procurement laws and policies need to be improved through the introduction of additional industrial and innovation development instruments
- The procurement impact of large projects may be enhanced through the introduction of contracts that allow for framework agreements for specific goods and related services of up to 10 years, allowing local companies to have longer time horizons and build internal capabilities. The significant purchasing power of Governments can also promote economies of scale. Agreements can be signed, in order for producers to be committed to complying with technical standards, quality levels, local value added rules, local employment targets, delivery dates and other relevant parameters

- Public procurement can also be used for innovation through tender specifications and performance requirements to encourage the diffusion or creation of a new technology or product. Tenders can also include an award criterion for innovative features and the requirements for demonstrable innovative characteristics in the product or service to be delivered. Firms involved in such long-term programmes can be aided through financial support and/or guarantees applicable in the local financial system
- Procurement laws should be made more friendly to small and medium-sized enterprises. Such enterprises are expected to benefit from the public procurement process, but there is no evidence that this is the case. An accomplished public procurement system should level the playing field for such enterprises. Small-sized contracts can be designed, actively promoted and reserved for such enterprises while simplifying the registration process, reducing documentation requirements and waiving registration costs and guarantee obligations. Tendering can be structured to allow for the splitting of orders into smaller lot sizes in order that suppliers of small and medium-sized enterprises can also participate in tenders and benefit from the public procurement process. The National Institute for Support to Microenterprises and Small and Medium-sized Enterprises should support the involvement of such enterprises in public procurement through technical assistance and training in areas such as management, financial management, understanding of the public procurement process and accessing of contract opportunities. Tender authorities should accept bank guarantees supporting bids from such enterprises, and commercial banks should take a winning bid contract as a guarantee for providing working capital or investment loans to such enterprises
- Procurement laws can also be a key mechanism in industrial greening. Existing procurement laws refer to environmental protection, yet few explicit measures have been adopted. Adopting green procurement clauses would help the recycling of construction material. Construction-related procurement contracts could stipulate the use of a certain amount of material from construction and demolition waste or require the use of a certain amount of refurbished material to be included, to reduce waste from electrical and electronic equipment. The Government could also promote green energy by procuring locally developed renewable energy products, components or solutions and developing industrial energy efficiency programmes in collaboration with electricity producers
- In addition to public procurement efforts, initiatives such as “buy Angolan” campaigns could be introduced in the near future to support local production. Such campaigns may be launched together with commercial local content schemes and could involve designating days or weeks during the year, for a period of several years, during which the population would be strongly encouraged to buy local products. Such initiatives could apply to both the business-to-consumer and the business-to-business markets
- New public procurement proposals can only succeed if the staff of procurement offices across the country are acquainted with the new initiatives and trained in implementing them. Improving internal procedures by making them clearer and more transparent, subject to international standards and the usual checks and controls, can help enhance trust in the system. Introducing and enforcing stricter penalties for dishonest conduct can also help deter negative behaviour and shift public procurement policies towards a more developmental focus

4.3.5 Industrial skills

Matching skills demand and supply, particularly regarding professional skills, is a challenge that extends beyond free trade zones. Such skills matching could become a significant driver of technological and industrial development in Angola. In August 2018–May 2020, 276 investment projects (120 of which were industrial), with the potential to create 18,800 jobs, were presented to the Private Investment and Export Promotion Agency, and analysis showed that the greatest demand for employment was in the food industry, followed by the wood and construction industries (European Union, 2021). The analysis (European Union, 2021) showed that groups of manufacturing industries

requiring a similar set of technical skills were process industries, wood and paper industries and shoe and clothing industries, as well as vehicle repair and maintenance; the similar skills necessary for these industries were automation, quality control, product logistics and sustainability; and 55 job types were identified across the industries, including welders and engravers (process industries), setters, carpenters, upholsterers and paper machine operators (wood and paper industries); tanners, skin preparers and sewing machine operators (shoe and clothes industries); and mechanics, turners, electricians, radio operators, locksmiths and bodywork specialists (vehicle repair and maintenance).

In Angola, vocational training provides a parallel stream of secondary school education. Starting at around age 14, students choose a three-year general academic education or a four-year technical vocational course, leading to a certificate degree. The Ministry of Education is responsible for supervising vocational education. In addition, professional training centres provide training and qualifications to young people and adults and the employed and unemployed, to facilitate integration into the labour market. In 2010, there were 450 technical and vocational training centres, including the following: 29 vocational training centres; 13 integrated centres for employment and vocational training; 35 mobile training centres; 59 pavilions for training in arts and trades; and 280 private training centres (Form Pro, 2014). The Ministry of Public Administration, Labour and Social Security, through the National Institute for Employment and Professional Training, is responsible for training.

In 2019–2020, the International Labour Organization and the United Nations Development Programme conducted field research in Huila Province to investigate the alignment between the technical and vocational education and training system and the labour market, and recommended that the system be reformed, to be more aligned with private sector needs (United Nations Development Programme and International Labour Organization, 2019). The Government has implemented some of the recommendations, as follows: apprenticeships have been regulated for the first time; a pilot apprenticeship programme (implemented by the United Nations Development Programme and funded by Türkiye) has benefited 150 young people trained at the National Institute for Employment and Vocational Training; the National Institute has opened new technical and vocational education and training centres across the country, which promote skills development in the agriculture sector; and an institutional dialogue on technical and vocational education and training, between the National Institute, the government of Huila Province and a local business association, was promoted by the United Nations Development Programme.

Since 2021, the United Nations Children's Fund and the United Nations Development Programme have been implementing a joint project (funded by Norway) to strengthen employment opportunities for youth in the Cazenga municipality. Under the project, 300 youth received scholarships to attend technical and vocational education and training courses, and an additional 300 youth benefited from apprenticeships in private companies.

The United Nations Development Programme is conducting a project on solar photovoltaics that includes direct support to three technical and vocational education and training centres, to ensure they are better equipped to provide training in installing and maintaining solar panels.

The Government is supporting vocational training as part of industrial diversification plans. In collaboration with the European Union, the National Institute for Employment and Vocational Training has initiated the revitalization of technical education and professional training, aimed at reducing unemployment by improving the vocational education and professional training system to develop the competencies required by the labour market (European Union, 2019). Under the revitalization, the following key challenges have been identified:

- Lack of communication and/or coordination between vocational education and professional training institutions; between technical schools and professional training centres and the potential employers of graduates; between the private and public sectors on the policies and profiles required; and between information on job opportunities and labour supply

- Deficit of teachers for vocational education and professional training and the lack of or poor technical support from the Ministry of Education and the Ministry of Public Administration, Labour and Social Security
- Poor teaching in technical schools and substandard training of professional training teachers
- Lack of management and data analysis knowledge by technical schools and professional training centres
- Lack of use and mistrust of statistical information

To address these issues, the project helps strengthen the strategic management capacity of relevant public institutions at the central and local levels and enhance coordination between them and the private sector. It also helps improve the quality and relevance of the content and qualifications provided by technical schools and professional training centres. Finally, the project helps facilitate and support the transition to the labour market of graduates of technical schools and professional training centres. In implementing these actions, the project is directly involved in developing the national staff training plan with the office of the President, the Ministry of Education and the Ministry of Public Administration, Labour and Social Security, as well as provincial and local authorities. Interventions take place at the highest State levels, as well as at intermediate and lower levels, with the private sector represented by business associations and representatives of small and medium-sized enterprises. The project also works directly with beneficiaries, including students and their families.

4.3.5.1 Recommendations

- The technical and vocational education and training system in Angola remains underfunded, fragmented, misaligned with the needs of the labour market and poor in terms of digitalization and connectivity. Dialogue between technical and vocational education and training centres, the private sector and other stakeholders is also limited. Strengthening the system is crucial to accelerating the economic diversification process, particularly in (incipient) manufacturing, but should be aligned with the national STI policy. In this regard, the Government should prioritize implementation of the revitalization of technical education and professional training, to ensure its objectives are successfully reached

4.3.6 Financing industry

As in many developing countries with a similar income level, the financial system in Angola has yet to be fully developed. The system consists of 26 commercial banks and the Debt and Securities Stock Exchange, mainly in government securities. Seven banks account for 80 per cent of total deposits, with many other banks not sizeable enough to play a role in the market (Embassy of the United States, Angola, 2021). The National Bank of Angola is gradually liberalizing the capital account to attract FDI. Limits to the availability of foreign exchange and the loss of correspondent banking relations since 2015 have led the National Bank of Angola to adopt restrictive monetary policies that negatively affect the payment system and have resulted in delays in foreign exchange-denominated international transfers (Embassy of the United States, Angola, 2021). Credit is limited, with foreign investors usually not accessing local credit and domestic investors facing high interest rates and collateral requirements of up to 125 per cent, driving local investors towards foreign banks or self-finance (Embassy of the United States, Angola, 2021).

Manufacturing finance is unique and requires specialized financing instruments. It differs from commercial lending, only occasionally involving funding for purchasing goods, inputs or commodities that require temporary credit supported by personal or corporate guarantees and that will be repaid soon after the merchandise has been used or sold, usually within one year. It also differs from large infrastructure projects requiring significant amounts of finance; complex financial arrangements and guarantees involving the Government, international banks and development

financial institutions; and long repayment periods. Manufacturing involves some large projects, such as in the petrochemical or aerospace industries, but manufacturing investment projects are located somewhere between large infrastructure projects and small projects or working capital finance. In addition, since the transformation of inputs through the application of machinery represents the essence of manufacturing, the main criterion in lending decisions is related to the nature of the equipment, machinery, production process and technologies being put together and whether this combination will be successful. The combination of project size, technology and maturity periods of 7–10 years makes manufacturing lending distinct and requires specialized lending institutions.

4.3.6.1 Recommendations

- Existing banking and finance conditions in Angola are not conducive to industrial development. In order for manufacturing to thrive, it is necessary to provide loans at the levels and rates required by the industry. The National Bank of Angola should therefore consider establishing an industrial development bank or an industrial finance division in another bank or providing manufacturing-focused lines of credit through existing banks (Guadagno, 2016). An industrial development bank or division could be established with a modest capital investment, which could be increased gradually as business picks up. The bank or division should provide manufacturing firms with loans according to their investment requirements and should offer loan syndication services for larger loans, credit guarantees, equipment leasing, support for feasibility studies and trade finance. Some of these credits should be provided at concessionary rates, particularly those related to priority industries. The bank should also provide venture capital and co-lead, with other corporate venture capitalists, funding for innovative manufacturing projects

4.4 Securing healthy food for the population: Food and beverages industry case study

The food and beverages industry dominates manufacturing in Angola. In 2020, over 58 per cent of all manufacturing was accounted for by this industry. Up to 2014, growth was initially the result of growing local consumer demand fuelled by the oil price boom, which brought about an increasing volume of domestic and foreign investment seeking to take advantage of the growing domestic market (Wolf, 2017). As the rise of oil prices slowed in around 2015, the need to save on foreign exchange and enhanced efforts by the Government to ensure food security, through the diversification of the economy into agriculture and the food processing industry, helped maintain investment in the industry. The Government had set high tariffs even before the fall in oil prices, to protect local agricultural and food products, except with regard to basic food items. By 2015, the average rate of 23.3 per cent for agricultural products was over twice the level in 2005 and over the average rate of 9.1 per cent for non-agricultural and non-oil products (Wolf, 2017). Despite the rapid growth in the industry, there is significant potential for further development, as most food for consumption is still imported.

The food industry is composed of the following four subsectors: meat processing and the preparation and preservation of meat, fish, fruit and vegetable products; grain milling and the manufacture of starches and their products; the manufacture of animal and vegetable oils and fats; and the production of dairy products. The key actors are importers (many of which are gradually shifting to packaging and eventually to local manufacturing), national producers (often members of larger economic groups) and foreign companies with local plants for manufacturing or packaging. Inputs are mostly imported, but the Government is promoting the substitution of local produce and aiming for companies to eventually turn such produce into exports.

In the meat processing industry, the largest initiative is the Kikuxi poultry and egg farm owned by a local holding group that controls companies primarily in the agribusiness sector. This high-volume automated poultry farm, with capacity to process 80,000 birds per week, co-exists with many small poultry farms organized in 120 associations through the National Association of

Poultry Producers and with four commercial farms producing chicken meat (Aldeia Nova, Emirais Farm, Kikovo, Munenga Society for Aviculture). The industry also includes more specialized producers such as a pork and poultry charcuterie producer owned by a company from Portugal and a local company, Carnes Valinho, in the charcuterie market.

In the grain milling and vegetable oils industries, among the largest producers is Grupo Carrinho, a local vertically integrated and diversified group of companies operating in the import and manufacturing of rice, soya, wheat, flour, vegetable oils, sugar and animal feed, and involved in agricultural work with local producers, transportation, processing, storage and the distribution of food products, as well as, recently, banking. Another large actor is Webcor Group from the Democratic Republic of the Congo, which focuses on agro-industrial food production and distribution, specializing in sourcing, manufacturing, distributing and trading wheat flour, pasta, edible oils, vinegar, condiments, animal feed and woven polypropylene packaging, and which has recently entered the confectionery industry through a cookie and candy factory newly constructed in partnership with Grupo Arco, a multinational confectionery company from Argentina. A smaller participant in the industry is the Mafricom Group from the Democratic Republic of Congo, specializing in the production of margarine.

The dairy products industry is dominated by Lactiangol (recently acquired by the Webcor Group), a producer of milk, butter and yoghurt (producing up to 12,000 litres of milk per hour), which provides milk in support of the government school meals programme. A major competitor is Nestlé, from Switzerland, which has opened a local factory to package its Nido brand, the best-known brand locally. The Mafricom Group has built a local factory to pack powdered milk.

Investment in the beverages industry is mainly from high-income countries and primarily concentrated in the production of alcoholic beverages (Wolf, 2017). The seven largest beer manufacturing plants are owned by BGI, the beer branch of the Castel Group, from France and, since 2012, other multinational enterprises have initiated or expanded production, including SAB Miller, Unicer and Lowenda Brewery; in 2013, the latter produced about 10 per cent of domestic beer output. The increased beer output led the tin can producer Nampak Bevcan, from South Africa, to establish production in Angola (Wolf, 2017). Refriango is a major local producer and the market leader in bottled water, soft drinks, juices and alcoholic beverages, with one of the largest plants in Africa, at 42 hectares and with 4,500 employees and a production capacity of 2.5 billion litres per year.

Given the continued expansion of the food and beverages industry in Angola and to export markets, emerging trends in the global food and beverages industry need to be considered. In recent years, consumers in developed countries, a major driver of the global food industry, have begun to shift from traditional price demands towards a greater emphasis on health and wellness, safety, social impacts, experiences and transparency as key criteria in decisions to purchase goods and services (Deloitte, 2016). Globally, there is an increasing number of deaths from non-communicable diseases, which were the leading cause of death worldwide in 2019 (24.4 million deaths or 44 per cent of total deaths) and may be related to eating habits and lifestyles (World Health Organization, 2020). Among other demands, customers are demanding healthy food and the reduction or elimination of fat, salt, sugar and pesticide residues. With regard to safety, demands include the reduction or elimination of allergens, toxins and carcinogens and with regard to transparency, more product information and availability across different media.

4.4.1 Recommendations

The early stage of development of the food industry in Angola provides the Government with a unique opportunity to develop first-mover policies that can help improve the quality and standards of the local industry while creating a healthy products brand name for products from Angola. Such strategic positioning can help improve not only life expectancy among the local

population but be valuable in accessing export markets. The shift towards healthy foods will require government action in several areas, as follows:

- Strengthen the food safety and control system, update food-related legislation and regulations and laboratory services and train the staff involved in food safety regulation and implementation
- Identify areas for improvement in the health and safety standards for locally produced food, in collaboration with the Ministry of Health and related institutions, international partners, local universities, agricultural associations and producers and local non-governmental organizations
- Adopt clear, transparent and well-researched food and drink standards
- Improve food labels with clear information about nutritional facts, to help consumers make the best choices
- Engage the food and beverages industry in finding ways to reformulate food and drink recipes and improve the availability of healthy foods and drinks
- Provide fiscal or regulatory incentives and public recognition to companies that shift to healthier products
- Introduce levies to some ingredients, as has been done in other countries, to encourage healthy eating habits and reduce the content of these ingredients in food
- Use public programmes and public procurement, such as school food programmes or hospital purchases, to procure healthier goods and showcase the drive towards healthier lifestyles
- Start awareness and educational campaigns with the participation of the Ministry of Education and the Ministry of Health, highlighting the importance of a healthy lifestyle, fresh food and physical activity

5. National innovation system: Digital and new technology

An overview of the state of digital technologies in Angola is presented in this chapter. ICT plays a crucial role in helping to improve access to health and education and to connect markets, thereby creating new sources for income and development (Dahlman et al., 2016; UNCTAD, 2018). The diffusion of mobile telephones in the first decade of the millennium and, more recently, of smartphones and broadband connections, has opened new channels for the circulation of ideas, which favours the recombination of knowledge in search of innovative solutions that can ensure sustained growth in modern economies.

The adoption and development of digital technologies in developing countries can act as a stimulus to connect with the global digital economy and as a driver of socioeconomic transformation in Africa (UNCTAD, 2021b; UNCTAD, 2022b; Yonazi et al., 2012). The digital transformation in economies in Africa has the potential to create jobs in the formal sector, encourage youth entrepreneurship, facilitate the participation of women in the labour force and increase farmer productivity (Calderon et al., 2019). However, a series of constraints, in terms of both human capital and infrastructure, may limit the achievement of the potential of digital technologies, which can have short-term negative effects, such as the displacement of traditional businesses, without the concomitant creation of new formal jobs.

An uneven pattern of engagement with the digital economy has been observed in Africa (Anwar and Graham, 2022). This is related to the high cost of accessing the Internet and the significant digital divide in terms of Internet access between urban and rural areas. In rural areas, the economics of network deployment by conventional methods is particularly challenging (Global System for Mobile Communications Association, 2021). However, their integration into the connected economy may have a particularly high socioeconomic impact. Significant gaps are registered not only within countries but also among countries; in 2019, about 92 per cent of workers from Africa registered on the largest digital work platforms were from only seven countries, namely, Algeria, Egypt, Kenya, Morocco, Nigeria, South Africa and Tunisia (Anwar and Graham, 2022). Similarly, only five countries account for about 80 per cent of the 1,200 digital platforms in Africa, namely, Egypt, Ghana, Kenya, Nigeria and South Africa (Global System for Mobile Communications Association, 2021). Active support for technology start-up companies and digital entrepreneurs, through both skills development and access to finance, is a key element in the development of a lively digital industry.

Development policies in Angola in the context of digital technologies face challenges in the following two concomitant areas: an equitable diffusion of ICT throughout the country and among different social groups should be guaranteed to provide equal opportunities for all citizens; and the diffusion and adoption of digital technologies should be sped up to keep pace with the growth of the digital sector both worldwide and among economies in Africa and to reap the potential positive effects of ICT on other sectors of the economy.

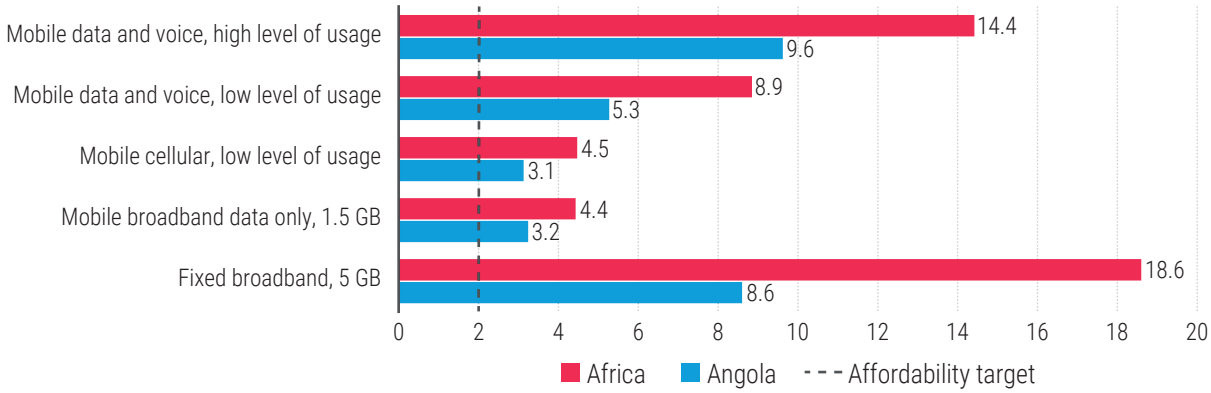
In the following sections, some indicators to assess the state of ICT diffusion in Angola compared with in other economies in Africa and the policy framework for ICT in Angola are presented, followed by policy recommendations.

5.1 The state of information and communications technology

Data transmission prices in Angola are relatively low compared with the average in Africa (figure 25). However, in 2020, prices were still higher than the affordability target of 2 per cent of monthly gross national income by 2025, set by the Broadband Commission for Sustainable Development, established in 2010 by the International Telecommunication Union and the United Nations Educational, Scientific and Cultural Organization with the aim of boosting the importance of broadband on the international policy agenda and expanding broadband access in all countries. In particular, the cost of a plan providing at least 5 GB of monthly high-speed data (> 256 kbit/s) corresponds to over 8 per cent of monthly gross national income per capita and the cost of a plan for 1.5 GB mobile data and voice with a high level of use, to slightly over 3 per cent of monthly gross national income per capita. On average, the costs of the same plans in developed countries correspond to 1.2 and 0.6 per cent of monthly gross national income per capita. The cost of an Internet connection thus continues to pose a barrier to the full diffusion of Internet access throughout Angola.

Figure 25

Affordability of Internet services as share of monthly gross national income per capita
(Percentage)

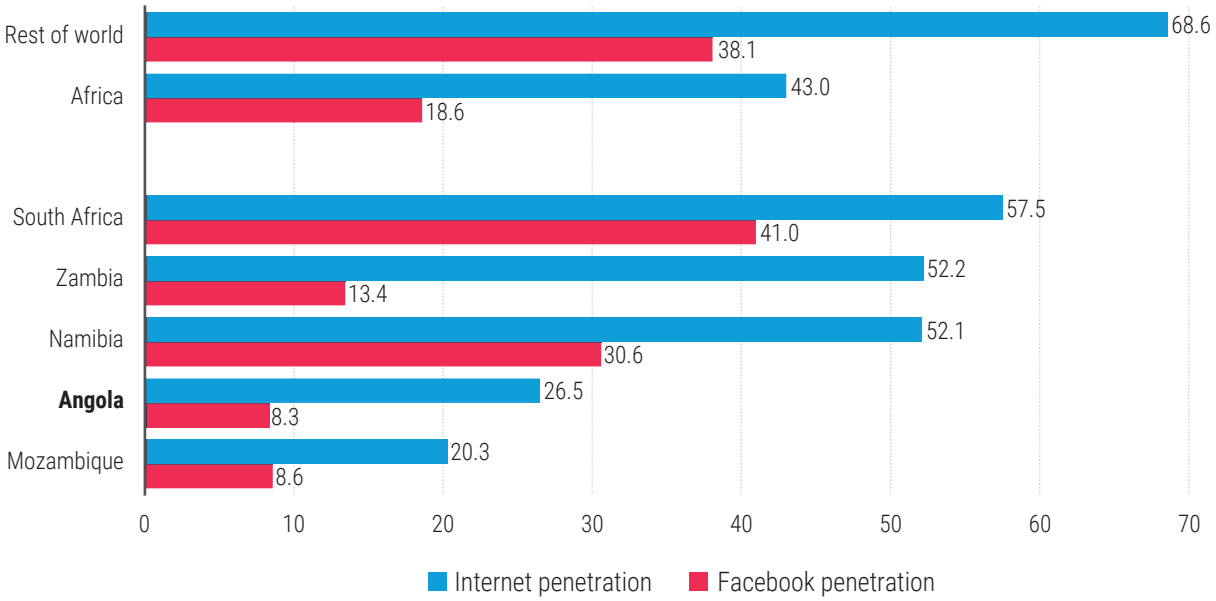


Source: UNCTAD calculations, based on data from the International Telecommunication Union.
Note: Prices refer to the cheapest plan providing the relative service from the operator with the largest market share.

Rates of both Internet and Facebook penetration in Africa are lower compared with other regions (figure 26). Differences between Africa and other regions are significant (43 per cent compared with 69 per cent and 19 per cent compared with 38 per cent). Angola also has low penetration rates in comparison with other sub-Saharan countries, such as South Africa, Namibia and Zambia. In Angola, only one person in four (26 per cent) has Internet access and about one person in 12 has an active Facebook account (8.3 per cent). Despite progress registered in the diffusion of the Internet throughout the country, particularly in 2012–2014, Angola has not yet reached a level of diffusion that would allow the digital transition of the economy to be sustained. Data from the Angolan Institute of Communications show that mobile telephone penetration decreased in 2014–2021, from about 54 per cent of the population to slightly below 47 per cent (Angolan Institute of Communications, 2022). A low rate of penetration of information technology constitutes a barrier to the unfolding of the potential of ICT in the economy of Angola.

Figure 26

Rate of information technology penetration
(Percentage)



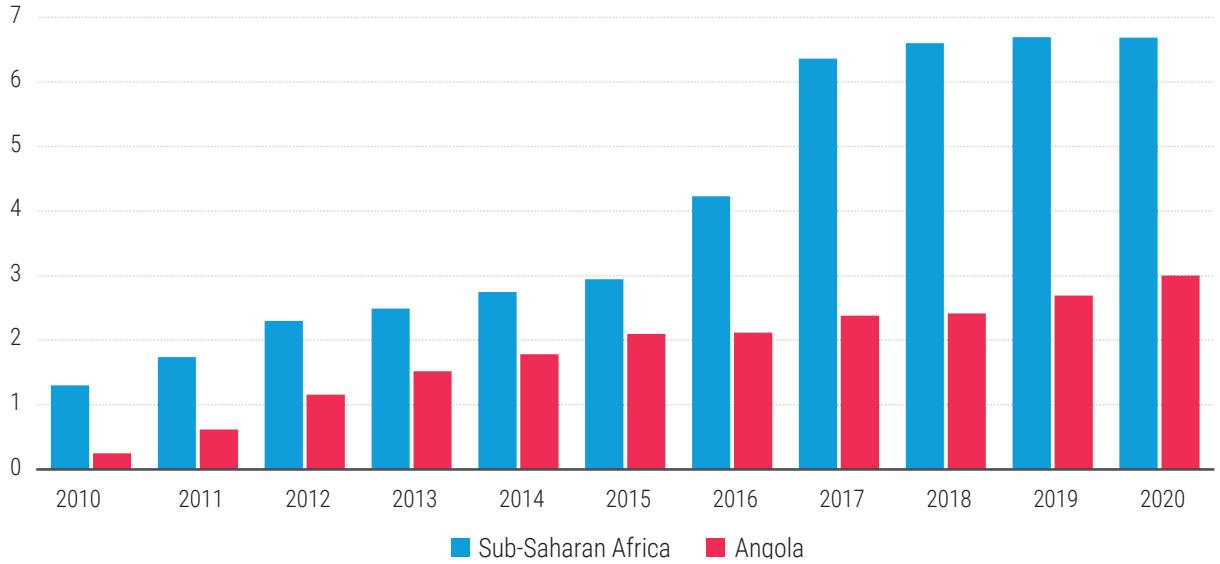
Source: UNCTAD calculations, based on data from the Population Division, Department of Economic and Social Affairs.
Note: Internet penetration is calculated as the number of users compared with the total population (mid-year 2021 estimates) and Facebook penetration is calculated as the number of subscribers compared with the total population, used as a proxy for the use of social networks in general.

The quality of Internet infrastructure is also an important element to be considered in assessing the overall performance of information technology in a country. Secure Internet servers refer to distinct, publicly trusted transport layer security or secure sockets layer certificates or valid third-party certificates for encrypted transactions. Private or self-signed certificates are not invalid but are generally not accepted by end-user browsers. In other words, secure transactions guarantee trustworthy connections, which are a key ingredient in guaranteeing the development of Internet-based businesses. In recent years, the number of secure servers per million people has sharply increased in sub-Saharan Africa (figure 27). The number of secure servers has also increased substantially in Angola; however, since 2016, the gap with the performance of sub-Saharan Africa has been increasing and, in Angola in 2020, the number of secure transactions per million people was about one fortieth of that in sub-Saharan Africa.

In Angola, the Internet and mobile markets appear to be concentrated (figure 28). Only two companies, Movicel and Unitel, have appreciable market shares and, in both markets, Unitel is the leader and, with 87 and 90 per cent of the markets, respectively, operates in a nearly monopolistic position. The levels of competition are low and additional efforts should be made to open up communications markets. The cable television market appears to be slightly less concentrated, yet also in this market, two companies account for about 94 per cent of subscriptions, and one company, Zap Sat, has a market share of 67 per cent. The fixed-line communications market at first glance appears to have the least amount of concentration, with three companies holding similar shares of 28–36 per cent. However, the company with the second largest share is a subsidiary of the market leader and concentration is therefore also high in this market.

Figure 27

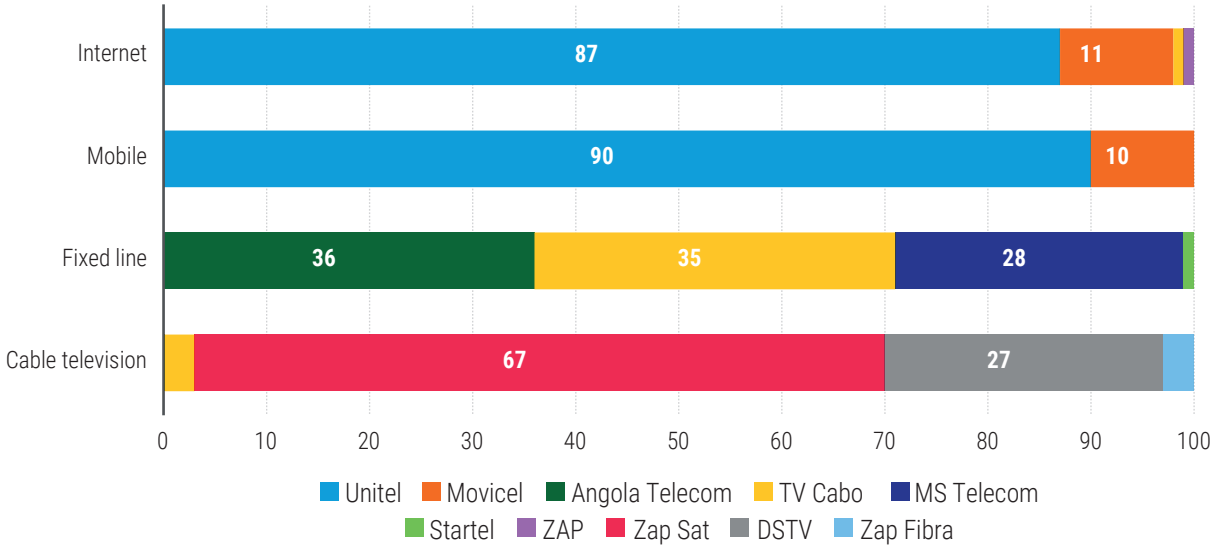
Secure Internet servers per 1 million people



Source: UNCTAD calculations, based on data from the World Development Indicators database.
Note: Weighted averages in December of a given year. Natural logarithms are computed based on the data, meaning that a linear growth pattern implies exponential growth. That is, the increase in the number of secure connections in sub-Saharan Africa in 2016–2017 corresponds to a 10-fold increase in the number of secure servers.

Figure 28

Angola: Shares of different digital markets, 2021
(Percentage)



Source: UNCTAD calculations, based on data from the Angolan Institute of Communications.
Note: Shares are computed based on the number of subscriptions.

Overall, there is a large margin for improvement in the ICT sector in Angola. Internet services prices remain relatively high and far from being affordable by a large part of the population. Despite some progress, particularly in 2012–2014, the Internet penetration rate remains low, including in comparison with countries at a similar stage of development. A low level of Internet use represents a significant barrier to the sustained and inclusive digital transition of the economy.

5.2 Bottom-up innovative initiatives from the business sector

Many in Angola perceive good opportunities to start a firm in the area in which they live, which is a sign of a certain degree of confidence and dynamism in the economy. The positive attitude towards new business opportunities may be partly the result of initiatives put in place to diffuse an entrepreneurial culture in Angola. An increasing number of bottom-up initiatives to support or directly create new and innovative businesses are flourishing and the dynamism of the start-up ecosystem is reflected by the inclusion of Luanda among the leading 1,000 cities in this area in a ranking by the research centre Start-up Blink. Many bottom-up innovative entrepreneurial activities in Angola leverage the opportunities offered by digital technologies to create new ideas for businesses or facilitate connections between actors. Initiatives for creating a dynamic and innovative business environment can be broadly grouped into the following two main categories: aggregators, which are incubators, accelerators, networking platforms and other initiatives supporting the creation of new business experiences; and start-ups, which are the result of innovative entrepreneurial activity that may be favoured by digital technologies (table 25).

Table 25
Angola: Examples of aggregators and start-ups

Aggregators	
Acelera Angola	An incubator providing support for management, training, mentoring and networking activities with a focus on financial technology, with over 72 start-ups in its portfolios and a varied group of national and international supporting organizations
Angola Innovation Summit	A knowledge network promoting innovation awareness as a key factor in economic and social development and in the acceleration of innovation ecosystems, with a mainly digital platform; the third summit in 2022 was the largest innovation event to date in Angola
Bantu Makers	A start-up studio helping to build companies using its ideas and resources; the concept involves seeking new businesses that can help solve major challenges in markets in Africa
Start-ups and successful start-ups scaling up businesses	
Appy Saúde	A mobile application allowing users to access reliable information on health establishments and order medical products and/or services online
Tupuca	The first online delivery platform, which began with food delivery and expanded to include an increased variety of products
T'Leva	A mobile application aiming to provide reliable journeys; there were over 50,000 direct downloads of the application from one application store in April 2022
Kepya Angola's Digital Agri Marketplace	A marketplace platform addressing some agribusiness challenges in Angola by linking agricultural professionals, buyers and transporters, to associate availability with needs in real time and secure transactions between users

Source: UNCTAD.

Many initiatives are based on specific technical competencies and attempt to leverage the opportunities offered by digital technologies. Digitally enabled businesses can remain within the ICT sector (such as when an innovative company uses a new protocol to improve the security or performance of a website) but often increasingly apply new technological solutions to improving performance or offering new products and services in more traditional sectors (retail, transport, agribusiness). The latter exemplifies the digital revolution, which is transforming all sectors of the economy. Support for the digital transition of an economy can no longer be confined to the ICT sector but should support and accompany change throughout the economy. A successful ICT strategy should have a broad focus on the digitalization of the economy as a whole.

A series of recurrent issues were highlighted by many of the interviewees during the preparation of the present review. Consideration of these elements can help identify bottlenecks and possible solutions, to achieve the potential of the business sector in Angola.

First, stakeholders from the business sector noted the lack of collaboration and coordination among the many initiatives. The innovative landscape is active and dynamic, but fragmented. The Government could support initiatives favouring the aggregation of different experiences, to foster the exchange of best practices and obtain regular feedback from the innovative entrepreneurial community. The Government should probably not take the lead in the entrepreneurial process given the risk of stifling the process. A softer approach may be desirable, such as through support for interactions between aggregators and the development of a close network of collaborations and knowledge exchanges, which can be achieved by directly financing collaborative initiatives and may have the advantage of creating one or more points of reference for the business community.

Second, the lack of finance and difficulties in accessing risk capital were noted, particularly in the early stages of business development. For example, the Angola Venture Capital Active Fund could facilitate the launch and expansion of new businesses, boosting entrepreneurship, supporting the development of business skills and promoting innovation and efficiency in small and medium-sized enterprises in Angola. However, it is not perceived by start-ups as acting as a supporting financial partner. Similarly, the National Institute for Support to Microenterprises and Small and Medium-sized Enterprises could serve digital start-ups yet has not been a strong partner of new companies in the sector. Focusing at least part of the activity of both organizations on new or micro-level innovative start-ups can help increase the dynamism of the business sector, particularly in targeting the needs of digital ventures. Difficulties in accessing financial capital were repeatedly noted and this issue was also highlighted in a map of the Luanda ecosystem, whereby 88 per cent of the interviewed actors considered it difficult to access capital and only 12 per cent had done so (Embassy of the United States, Angola, et al., 2019).

Third, many innovative entrepreneurs had training experience from abroad and/or took stock of the expertise of experts from other countries. This is particularly important as it serves to highlight the role of the diaspora as a factor in the success of innovative entrepreneurial ventures. Programmes supporting training abroad can help in learning new knowledge from more advanced economies and creating a critical mass in emerging areas in which achieving the same domestically might be difficult or take more time. This applies, among other areas, to digital competencies that are and will be the backbone of new industries; for example, computer engineer and data scientist are among the professions of which there is a shortage worldwide. However, the Government should determine the possible options for promoting the engagement of the diaspora. An example of an initiative in this regard is Start-up Chile, a public accelerator focusing on technological and innovative businesses with scale-up opportunities, which has supported over 2,200 innovative start-ups. The success of this initiative, in its lean organizational activities and in the attraction of ideas and businesses from abroad, has been due in part to the focused activity, the prominent role of entrepreneurs in comanaging the initiative and the openness to business ideas worldwide, with support for the necessary visas for foreign start-ups; in 2021, over 80 per cent of the budget was allocated to foreign entrepreneurs.

5.3 National information and communications technology strategy

Guidelines under the ICT strategy are provided in the long-term strategy for development (Angola 2025). The main objective for government action with regard to ICT is to ensure the development and expansion of support infrastructure for the provision of diversified information and communications services, which should be available to both the State administration and society, in all regions of the country, and should be of good quality and at affordable prices. These

conditions, when met, are the main driving forces contributing to the promotion of new initiatives and strategies based on modern technology, including electronic education, governance, medicine and commerce.

The long-term objectives are defined in the strategic plan in the White Paper on ICT 2019–2022, under the responsibility of the Ministry of Telecommunications, Information Technology and Social Communications. The establishment of the Ministry is an important institutional step with regard to the recommendations of the STI policy review conducted in 2008 whereby, in that year, national efforts to build an information society were not managed by a dedicated ministry but coordinated through a cross-sectoral body. The establishment of a dedicated ministry integrating different functions reflects recognition of the increasing importance of digital technologies in the economy and on the policy agenda. Among the challenges and opportunities in the digital sector, the White Paper on ICT 2019–2022 identifies a set of priorities or policy measures, which should be met through an increase in direct and indirect investment in the ICT sector and reform of the conditions governing the Internet economy (table 26).

Table 26

Angola: Information and communications technology priorities

For all
Developing an information technology infrastructure over the entire territory and ensuring affordable prices everywhere
Ensuring universal access to ICT
Ensuring open and equitable access to the international interconnections required for the insertion of Angola into regional and international markets
For industry and markets
Fostering the creation of the ICT industry in Angola
Stimulating investment and tax policies to attract national and foreign private investment in the ICT industry
Stimulating competition in the electronic communications market
Other priorities
Ensuring the development and modernization of the meteorology, geophysics and postal services
Ensuring the management of response teams for information technology incidents
Consolidating the national space programme with the creation of a space agency
Promoting efficient management of the radio spectrum
Promoting the creation of an information society observatory
Creating an accreditation authority and certifying authorities for the implementation of key public infrastructure

Source: UNCTAD, based on Ministry of Telecommunications, Information Technology and Social Communications, 2021.
Note: ICT for all denotes priorities related to the objective of guaranteeing reliable communications at affordable prices across Angola; progress in this area is critical as Angola lags behind in comparison with other countries in Africa. ICT for industry and markets denotes priorities related to the creation of ICT businesses and a competitive digital industry in the country; communications markets remain concentrated and the development of ICT-based businesses may require dedicated support. Other priorities denote supporting actions, ranging from management of the radio spectrum to the national space programme and the creation of bodies to ensure better control over the use of personal data and information services.

In achieving its goals and conducting a series of structural projects, the Ministry of Telecommunications, Information Technology and Social Communications is supported by the following three dedicated institutions, acting in cooperation with the Ministry through its council:

- Angolan Institute of Communications, responsible for providing advice and representing the Ministry through the regulation, supervision and inspection of the communications sector

- DNS.ao, responsible for registering and maintaining websites using the country-code domain.ao. They provide other protocol addresses and autonomous systems numbers in the country
- Infosi, responsible for providing scientific and technological services, to promote and foster the development of the information society

The Ministry of Telecommunications, Information Technology and Social Communications also implements, directly or indirectly, a series of systemic projects that, together with the implementation of policies, are aimed at restructuring processes and technology management and providing timely support in certain fields, including the following: restructuring of Angola Telecom, aimed at reinforcing its economic and financial sustainability; providing free Internet hotspots across the country, through the Angola Online project implemented by Infosi (in March 2022, about 38 per cent of the hotspots were concentrated in Luanda); and expanding satellite communications services in Angola (in 2017, the first satellite was launched; in 2019, the national space programme was authorized to sign a contract with Airbus to manufacture a third satellite; and in 2022, a second geostationary satellite is expected to be launched (Africa News, 2021)).

The Government is implementing actions covering a broad set of different approaches, to sustain the transition to the digital economy. However, an analysis of documentation and interviews with stakeholders help identify areas for improvement that have not yet been at the centre of action. One of the objectives in the national strategy and a prerequisite for successful transition to the digital economy is the development of the digital skills necessary to identify the opportunities offered in local and global markets and to run successful digital businesses. Further efforts are required in this field, to improve digital skills throughout the country and favour employment and entrepreneurship in ICT. Achieving this objective may require close interaction with other ministries, such as the Ministry of Economy and Planning, with regard to employability and direct support for the creation of ICT businesses, and the Ministry of Higher Education, Science, Technology and Innovation, with regard to skills and education. In addition, Internet access in some universities appears limited, partly due to budgetary issues that could be solved through closer collaboration between the Ministry of Higher Education, Science, Technology and Innovation and the Ministry of Telecommunications, Information Technology and Social Communications. Given that a strategy for industrial diversification also relies on universities and public research centres, it is essential that they have stable Internet connections. In this regard, Angola is performing relatively well in terms of digital government but not in the other two pillars of the digital economy, namely, the development of a robust marketplace for digital trade, digital financial services and digital content; and the development of a digitally skilled workforce grounded on sound ethical practices and sociocultural values (Nyakanini et al., 2020).

5.4 Recommendations

Angola has made many improvements with regard to digital technologies, but challenges remain. The Government should resolve existing constraints, in terms of both human capital and infrastructures that may lead to bottlenecks in the digital transition, to create opportunities for all citizens. Based on the analysis, the following findings and policy recommendations are highlighted:

- The Government should invest in reducing the cost of Internet connections, which represents a barrier to the full diffusion of access. Price reductions can be achieved through the promotion of competition in communications markets, targeting the entrance of new providers using existing networks
- More in-depth monitoring of Internet access diffusion is needed to understand the digital gap and identify places (e.g. rural regions) or population groups that should be prioritized by government action. Monitoring can be done through a public–private initiative involving authorities under the

Ministry of Telecommunications, Information Technology and Social Communications and large ICT operators in the country

- The quality of connection, in terms of both transmission and reliability of source, is an important factor in the development of digital businesses. The gap with other countries in sub-Saharan Africa in widening. Initiatives such as Angola Online are good examples and may be scaled up, to ensure increasing operational activity beyond Luanda
- Direct and indirect support for development of a digital-based business sector should be strengthened. Financial constraints can be eased through greater focus on the activities of existing mechanisms (e.g. Angola Venture Capital Active Fund and National Institute for Support to Microenterprises and Small and Medium-sized Enterprises) towards digital start-ups, microenterprises and small enterprises and through improved accountability. Coordination between initiatives can be improved by recognizing the role of business aggregators in the national ecosystem and providing dedicated support
- The creation of a public start-up initiative with significant involvement from the private sector could act as a catalyst for an innovative ecosystem and also help attract ideas and businesses from other countries, representing an opportunity to create critical mass in innovative businesses in Angola, such as in the example of the experience of Start-up Chile
- An education and training strategy promoting and diffusing digital skills and values throughout the economy can help support the transition towards the digital economy. Education is a priority of the Ministry of Higher Education, Science, Technology and Innovation and programmes will be designed mainly with universities and other high education institutions yet collaboration with the Ministry of Telecommunications, Information Technology and Social Communications can help improve the alignment of programmes with the needs of the digital business environment. Such interactions could form part of the broader institutional collaborative set-up
- Universities and other high-level education institutions should be supported in acting as drivers of the digital transition and providing support for the development of the national innovation ecosystem. Access to stable and fast Internet connections and Wi-Fi hotspots should be in place in all educational establishments. To circumvent budgetary issues at the local level, connections should initially be directly ensured and sponsored by the Government, until complete coverage has been achieved, through a dedicated budget line

6. Conclusion

Ensuring that the national innovation system is fit for purpose requires government actions in the following five areas: redesigning the system; prioritizing activities; rationalizing initiatives; balancing perspectives; and incentivizing stakeholders.

The national innovation system has grown significantly since the start of the millennium and its formal establishment in 2011. Following the end of the civil war, over a period of nearly 12 years, the system expanded significantly and is now beginning to be restructured. The results, however, have not been as expected and there are limitations in key areas. A redesign of the system appears to be needed, with regard to its strategic orientation towards technology and national development priorities; and in the use of policy instruments by the Government, shifting to a more data-driven approach to policymaking, including the use of evidence-based evaluation and statistics. A redesign is also required in the mechanism of coordination between government agencies and between the agencies and the private sector. Finally, a redesign is also required in the approach to building an entrepreneurship ecosystem, better distinguishing necessity-driven from opportunity-driven entrepreneurs and adapting policies to each. A fresh, joint perspective could be taken on all of these aspects, and a new blueprint designed for the next 10–15 years.

The national innovation system is broad and spread thin. Demand is significant, resources are limited and there is pressure to distribute resources widely. This situation is not conducive to ensuring a national innovation system that drives technological change and, as a result, national development. Priority-setting should not simply involve labelling a sector or activity as a priority but focus on identifying those that, with allocated resources, can make a significant difference in terms of growth and development impacts. Such sectors or activities are usually few and specific. Priorities in this regard include scientific areas with a technological potential, technological development, particular manufacturing sectors, high-performance research institutes and researchers and a greater education budget. A science and technology park at least partially focused on development priorities may make a significant contribution to the well-being of Angola in the future.

Restructuring of the national innovation system by the Government through the consolidation of institutions appears necessary. Yet rationalization requires the consideration of where economies of specialization or complementarity may be achieved. The combined focus in the Ministry of Higher Education, Science, Technology and Innovation on higher education and science and technology can contribute to the advancement of the national innovation system, if technology and innovation functions are properly taken on board. In addition, the incorporation of research centres into departments or faculties can help reinforce the teaching function and orient research to where it can be socially useful. Further rationalization will be required among research institutes and other agencies of the national innovation system but should be driven less by the aim of reducing costs or waste and more by the main objective of achieving synergies and building centres of excellence than can take the lead in particular scientific and technical areas.

Addressing the different interests and aspirations of universities, scientists and the private sector requires a careful balance of the different perspectives while focusing on priorities. Areas of challenge and demands faced by implementers include researchers and teachers, science and technology, employment and entrepreneurship, functional specialization and intersectoral cooperation, centralization and decentralization. Setting and meeting priorities is critical and accommodating other perspectives, along with bringing other stakeholders on board, needs to be carefully managed. The setting of priorities should not mean the exclusion of non-priority initiatives.

Finally, the Government should begin to shift its policy tools towards the widespread use of incentives. Improving research, the quality of research institutes and higher education institutions, the quality of entrepreneurship, the support provided to the entrepreneurship ecosystem, the

involvement of the private sector in research and development and innovation and, more generally, collaboration between stakeholders, can be achieved through different types of incentives and inducements available to the Government. A key dimension of the redesign of the national innovation system should be the use of incentive mechanisms.

7. Summary of main recommendations

Strategy

1. The Ministry of Higher Education, Science, Technology and Innovation should develop a new national innovation system strategy, accompanied by an updated and upgraded set of policies and incentives, as well as a new coordination mechanism.

Governance

2. The Ministry of Higher Education, Science, Technology and Innovation should take a more active role in promoting technology and innovation. In this regard, organizational structures and related mechanisms should be put in place that allow for a closer and more coordinated approach to technological upgrading and innovation under the stewardship or influence of the Ministry.
3. The Ministry of Higher Education, Science, Technology and Innovation should be incorporated into the Intersectoral Commission of the Production Support, Export Diversification and Import Substitution Programme. Including the Ministry in the Programme leadership will signal that technology upgrading and innovation are intended to be at the centre of industrial development.

Institutional framework

4. Decisions to close or merge research or technological institutes should consider the quality of research or technological enhancement and its contribution to society, as well as possible synergies and the consolidation of particular areas. The evolving organizational structure of the national innovation system needs to be assessed in terms of past performance, the possibilities of achieving economies of scale and scope and the developmental potential of the activities undertaken.

Institutional capacity

5. The Ministry of Higher Education, Science, Technology and Innovation should improve its implementation capacities. STI road maps, calendars, roles and responsibilities, enforceable and realistic targets with measurable indicators and process and content costings need to be established. New consultative bodies need to be staffed not only by scientists but also by individuals with managerial and technical expertise, and should have a strong private sector presence. Learning from other STI initiatives, such as the Programme for the Development of Science and Technology, which has its own management techniques, would add to the managerial capacities of the Ministry.

Entrepreneurship development

6. A national entrepreneurial strategy should be prepared, with clear objectives and a strong and operational institutional framework.
7. The official entrepreneurship support programmes in Angola should shift towards supporting individuals with the best business ideas, with criteria for assessing ideas used as the main support requirement. The qualification criterion for an entrepreneurship programme should not be employment status but the soundness of a business idea. The purpose of an entrepreneurship ecosystem is to create dynamic firms, not to generate employment. Employment will follow if the ecosystem is successful.

8. A two-tier support approach to entrepreneurship ecosystem-building should be developed, to deal with differences in entrepreneurial skill levels. A basic business support tier, ensuring that the business case is well developed, addressing basic management and business skills and providing "hand-holding" for the entrepreneur until their idea gets off the ground, could focus mainly on necessity-driven entrepreneurs. A more technically oriented support tier, linked to universities and research centres and assisted by technology or industry-specific institutes, funding and bank collateral mechanisms and international collaborations, could focus mainly on opportunity-driven entrepreneurs.

9. Government and private investment should establish mechanisms and facilitate the interactions required to develop the second entrepreneurship ecosystem-building tier. Initial efforts should be related to the diversification priorities concerning exports and import substitution. The Ministry of Higher Education, Science, Technology and Innovation could take the lead, in close collaboration with the Ministry of Economy and Planning and the ministries responsible for different sectors, to improve coordination.

10. Direct and indirect support for development of a digital-based business sector should be strengthened. Financial constraints can be eased through greater focus on the activities of existing mechanisms (e.g. Angola Venture Capital Active Fund and National Institute for Support to Microenterprises and Small and Medium-sized Enterprises) towards digital start-ups, microenterprises and small enterprises and through improved accountability. Coordination between initiatives can be improved by recognizing the role of business aggregators in the national ecosystem and providing dedicated support.

11. A public start-up initiative could be created, with significant involvement from the private sector, as this could act as a catalyst for an innovative ecosystem and also help attract ideas and businesses from other countries, representing an opportunity to create critical mass in innovative businesses in Angola.

Economic diversification

12. Strategic priorities for economic diversification, focusing on export and import substitution opportunities, should be set. The sectors of machinery and mechanical appliances, plastics and articles thereof, iron and steel and pharmaceutical products are among the sectors with the greatest opportunities for export to global markets. The first three also lead the list of sectors with opportunities for export to African markets. Pharmaceutical products and organic chemicals offer significant opportunities for import substitution and export to global markets. Both are associated with a strong cluster of scientific publications, indicating potentially successful industry–research partnerships.

13. Procurement laws and policies should be improved through the introduction of additional industrial and innovation development instruments, to support the development and further diversification of local production.

14. The development of agriculture and increase of agricultural productivity should play a greater role in economic diversification. Most of the sectors with significant potential for export to African markets also rank high with regard to global markets and import substitution. Cereals and livestock-related products appear to be the most promising agribusiness categories for diversification.

Scientific capacity

15. The Ministry of Higher Education, Science, Technology and Innovation should increase science-related funding, to prevent falling behind global performance, in addition to improving the organizational structure of higher education and research institutes, which could help save resources

16. The Ministry of Higher Education, Science, Technology and Innovation should focus science-related support on priority areas for economic diversification. The Government should allocate a significant proportion of resources to priorities and incentivize joint university and industry projects in these areas. Scientific freedom should also be respected and encouraged through some government support and by targeting private and/or international support and funding.

Research and development capacity

17. The Government should increase the budget allocated to research and development, to meet the target of 1 per cent of GDP for research and development.

18. The Ministry of Higher Education, Science, Technology and Innovation should increase incentives for research activities linked to industrial development. Incentives should be accompanied by an increase in the number of visits, exchanges and training programmes with higher education institutions abroad. Investment in laboratories and equipment should be increased.

19. The Ministry of Higher Education, Science, Technology and Innovation should implement a conscientious, strict and research-focused process of certification for all private and public higher education and research institutes, emphasizing scientific and applied research. Encouraging institutions and providing temporary incentives to the corporate private sector to both invest in in-house research and development and work more closely with universities and research institutes should also be part of the approach of the Government.

20. In the transition period, the Angolan diaspora and foreign academics could be invited on a short-term or medium-term basis to support the renewed higher education sector in Angola. International partnerships and participation in international research projects should be encouraged and additional donor funding and international finance should be procured for this purpose.

Education

21. Universities and technical professional centres could shift entrepreneurship education towards experiential learning, to develop the competencies required to bring about a critical mass of young entrepreneurs.

22. A fundamental rethinking of the standards of secondary and tertiary education and technical and vocational education and training should be implemented, as required in improving the quality of the workforce.

23. The Government should prioritize implementation of the revitalization of technical education and professional training, to ensure its objectives are successfully reached

Digital skills

24. An education and training strategy promoting and diffusing digital skills and values throughout the economy could be established, as it can help support the transition towards the digital economy. Education is a priority of the Ministry of Higher Education, Science, Technology and Innovation and programmes will be designed mainly with universities and other high education institutions yet collaboration with the Ministry of Telecommunications, Information Technology and Social Communications can help improve the alignment of programmes with the needs of the digital business environment. Such interactions could form part of the broader institutional collaborative set-up.

Information and communications technology infrastructure

25. The Government should invest in reducing the cost of Internet connections, which represents a barrier to the full diffusion of access. Price reductions can be achieved through the promotion of competition in communications markets, targeting the entrance of new providers using existing networks.

26. Initiatives such as Angola Online are good examples and could be scaled up, to ensure increasing operational activity beyond Luanda, given that the quality of connection, in terms of both transmission and reliability of source, is an important factor in the development of digital businesses; and the gap with other countries in sub-Saharan Africa in widening.

27. Universities and other high-level education institutions should be supported in acting as drivers of the digital transition and providing support for the development of the national innovation ecosystem. Access to stable and fast Internet connections and Wi-Fi hotspots should be in place in all educational establishments. To circumvent budgetary issues at the local level, connections should initially be directly ensured and sponsored by the Government, until complete coverage has been achieved, through a dedicated budget line.

Investment

28. A more targeted approach to attracting investment should be adopted, as it is critical to development of the manufacturing sector. Existing incentives are generous; the next step could be to identify a few high-impact manufacturing projects and seek investors, both locally and abroad. However, a cautious approach should also be taken, as flexibility and discretion in negotiations could lead to corruption; both the individuals involved in negotiating teams and the procedures adopted should therefore be carefully selected.

29. Local content rules should be expanded with local content targets, and the targets should be complemented by a supplier development programme.

Special economic zones

30. The Government should address any issues of lack of coordination and information, and build technical and managerial capacities among the staff involved in free trade zones. A purpose-built high-level task force with the power to identify problems and suggest solutions needs to be established as soon as possible to maintain the momentum created by the new law.

31. To promote regional development, infrastructure and investment facilitation in free trade zones beyond the capital should be improved, to make them more attractive.

32. The development of free trade zones should be connected to government investment and diversification priorities, and investment targeting should be used to locate activities in free trade zones, particularly export-oriented projects.

33. Free trade zones should engage in global value chains.

Finance

34. Decisions related to financial support for research and technological development institutes should be linked to national diversification potential. Programmes or institutes that do not meet the criteria should be encouraged to obtain alternative funding and be advised to close or merge, since lack of achievement in the past will be considered in future funding applications.

35. Angola should increase short-term and long-term finance for the national innovation system. In the short-term, a greater budget should be allocated to certain elements. Initially, efficiency saving and the reallocation of funds will be needed. The Government may seek further international finance. However, the main area of expansion of finance for the national innovation system should come from the private sector through higher levels of investment in research and development and innovation by large firms and through the banking system.

36. The Foundation for the Development of Science and Technology should carefully balance the allocation of resources between science and technology and establish a set of particular and narrow priorities in order that funding can make an impact. In addition, priorities should be aligned with national development and manufacturing priorities.

37. The National Bank of Angola should therefore consider establishing an industrial development bank or an industrial finance division in another bank or providing manufacturing-focused lines of credit through existing banks. The bank or division should provide manufacturing firms with loans according to their investment requirements and should also provide venture capital and co-lead, with other corporate venture capitalists, funding for innovative manufacturing projects.

Monitoring and evaluation

38. The Government should improve STI-related data collection and statistics.

39. More in-depth monitoring of Internet access diffusion is needed to understand the digital gap and identify places (e.g. rural regions) or population groups that should be prioritized by government action. Monitoring could be done through a public–private initiative involving authorities under the Ministry of Telecommunications, Information Technology and Social Communications and large ICT operators in the country.

Bibliography

Africa News (2021). The Angolan national space programme. Available at https://africanews.space/the-angolan-national-space-programme.

African Union (2015). Agenda 2063: The Africa We Want. Available at https://au.int/en/Agenda2063/popular_version.

African Union-New Partnership for Africa's Development (2010). *African Innovation Outlook 2010*. Pretoria.

African Union Development Agency-New Partnership for Africa's Development (2014). *African Innovation Outlook 2014*. Pretoria.

African Union Development Agency-New Partnership for Africa's Development (2019). *African Innovation Outlook 2019*. Johannesburg, South Africa.

Alcorta L and Peres W (1998). Innovation systems and technological specialization in Latin America and the Caribbean. *Research Policy*. (26):857–881.

Alcorta L and Tesfachew T (2020). Special economic zones and export-led growth: An industrial policy imperative. In Okubay A and Lin JY. *The Oxford Handbook of Industrial Hubs and Economic Development*. Oxford University Press, United Kingdom.

Alvarez-Cuadrado F and Poschke M (2011). Structural change out of agriculture: Labour push versus labour pull. *American Economic Journal: Macroeconomics*. 3(3):127–158.

Angolan Institute of Communications (2022). Statistics. Available at https://inacom.gov.ao/ao/mercado/estatistica/movel-celular.

Anwar MA and Graham M (2022). *The Digital Continent: Placing Africa in Planetary Networks of Work*. Oxford University Press, United Kingdom.

Audretsch DB and Belitski M (2022). *Knowledge Collaboration, Productivity and Innovation*.

Azoulay P, Jones BF, Kim JD and Miranda J (2020). Age and high-growth entrepreneurship. *American Economic Review: Insights*. 2(1):65–82.

Balconi, Brusoni and Orsenigo (2010). In defence of the linear model: An essay. *Research Policy*. 39(1):1–13.

Barbosa de Oliveira M (2014). Technology and basic science: The linear model of innovation. *Scientiæ studia*. 12(Special issue):129–146.

Bosma N, Hill S, Ionescu-Somers A, Kelley D and Guerrero M (2021). *Global Entrepreneurship Monitor: 2020/2021 Global Report*.

Bosma N and Kelley D (2018). *Global Entrepreneurship Monitor: 2017/2018 Global Report*.

Calderon C, Kambou G, Korman V, Kubota M and Canales CC (2019). Africa's pulse: An analysis of issues shaping Africa's economic future. No. 19, April. World Bank.

Catholic University of Angola, Centre for Scientific Studies and Research (2019). Angola Economic Report 2018. Luanda.

Catholic University of Angola, Centre for Scientific Studies and Research (2021). Angola Economic Report 2019-2020. Luanda.

Clark KB and Wheelwright SC (1992). Organizing and leading heavyweight development teams. *California Management Review*. 34(3):9–28.

Dahlman C, Mealy S and Wermelinger M (2016). Harnessing the digital economy for developing countries. Organisation for Economic Co-operation and Development.

Deloitte (2016). Capitalizing on the shifting consumer food value equation.

Development Bank of Angola (2019). Production Support, Export Diversification and Import Substitution Programme. Economic Studies Office. Information Note No. 12.

Edquist C (2005). Systems of innovation: Perspectives and challenges. In Fagerberg J, Mowery D and Nelson R, eds. *Oxford Handbook of Innovation*. Oxford University Press, United Kingdom.

Economic and Social Commission for Asia and the Pacific (2012). *Economic and Social Survey of Asia and the Pacific 2012: Pursuing Shared Prosperity in an Era of Turbulence and High Commodity Prices*.

Embassy of the United States, Angola, Acelera Angola and Ideia Lab (2019). Luanda entrepreneurial ecosystem mapping report. Available at https://ao.usembassy.gov/ecosystem-mapping/.

Embassy of the United States, Angola (2021). 2021 Investment Climate Statements: Angola. Available at https://ao.usembassy.gov/wp-content/uploads/sites/234/Investment-Climate-Statement-Copy.pdf.

European Union (2019). Project summary. Available at https://europa.eu/capacity4dev/projetoretfop/documents/sintese-do-projecto-retfop.

European Union (2021). Specialized study of the labour market and economic activities: Final report. Study carried out for the Project on Revitalization of Technical Education and Professional Training in Angola (FED/2017/387-453).

Fagerberg J (2005). Innovation: A guide to the literature. In Fagerberg J, Mowery D and Nelson R, eds. *Oxford Handbook of Innovation*. Oxford University Press, United Kingdom.

Farole T (2011). Special economic zones in Africa: Comparing performance and learning from global experiences. World Bank.

Felipe J, Kumar U, Abdon A and Bacate M (2012). Product complexity and economic development. *Structural Change and Economic Dynamics*. 23(1):36–68.

Ferreira M (2006). Angola: Conflict and development, 1961–2002. *Economics of Peace and Security Journal*. 1(1):25–29.

Foray D, David PA and Hall B (2009). Smart specialization: The concept. *Knowledge Economists Policy Brief*. 9(85):100.

Form Pro (2014). Professional formation. Available at https://www.formpro.org/en/article/82.professional-formation.html.

Freeman C (1987). *Technology Policy and Economic Performance: Lessons from Japan*. Pinter. London.

Freire C (2017). Economic diversification: Explaining the pattern of diversification in the global economy and its implications for fostering diversification in poorer countries. Working Paper No. 150. Department of Economic and Social Affairs.

Gereffi G (2020). What does the COVID-19[coronavirus disease] pandemic teach us about global value chains? The case of medical supplies. *Journal of International Business Policy*. 3(3):287–301.

Godin B (2006). The linear model of innovation: The historical construction of an analytical framework. *Science, Technology and Human Values*. 31(6).

Golub S and Prasad V (2016). Promoting economic diversification and international competitiveness in Angola. Report prepared for UNCTAD.

Government of Angola (2021). Voluntary national review of the implementation of the 2030 Agenda for Sustainable Development.

Government of Angola (2022). Credit support project. Available at https://governo.gov.ao/ao/governo/programas-de-accao-governativa/pac.

Government of Angola, Private Investment and Export Promotion Agency (2022). Statistics. Available at https://www.aipex.gov.ao/PortalAIPEX/#!/estatisticas_aipex/estatisticas.

Global System for Mobile Communications Association (2021). *The Mobile Economy: Sub-Saharan Africa 2021*. London.

Guadagno F (2016). The role of industrial development banking in spurring structural change. Inclusive and Sustainable Industrial Development Working Paper No. 8. United Nations Industrial Development Organization.

Hausmann R and Hidalgo CA (2011). The network structure of economic output. *Journal of Economic Growth*. 16(4):309–342.

Hausmann R and Klinger B (2008). Achieving export-led growth in Colombia. Working Paper. Centre for International Development, Harvard University, United States.

Hidalgo CA and Hausmann R (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences*. 106(26):10570–10575.

Hidalgo CA, Klinger B, Barabási A-L and Hausmann R (2007). The product space conditions the development of nations. *Science*. 317(5837):482–487.

International Finance Corporation (2019). *Creating Markets in Angola: Opportunities for Development Through the Private Sector*. Washington, D.C.

International Monetary Fund (2014). Sustaining long-run growth and macroeconomic stability in low-income countries: The role of structural transformation and diversification. Policy Paper.

Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (2018). *Guidance for Governments: Local Content Policies*. Winnipeg, Canada.

Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (2019). *Local Content Policies in the Mining Sector: Scaling up Local Procurement*. Winnipeg, Canada.

Kim L (1997). *Imitation to Innovation. The Dynamics of [the Republic of] Korea's Technological Learning*. Harvard Business School Press. Cambridge, United States.

Lee K (2005). Making a technological catch-up: Barriers and opportunities. *Asian Journal of Technology Innovation*. 13(2):97–131.

Li X and Liu X (2005). FDI and economic growth: An increasingly endogenous relationship. *World Development*. 33(3):393–407.

Liberato E (2021). Analysis of the innovation ecosystem in Angola. Final report. United Nations Development Programme. Luanda.

Lin J, Cader M and Pietronero L (2020). *What African Industrial Development Can Learn from East Asian Successes*. International Finance Corporation. Washington, D.C.

Lin J and Monga C (2010). Growth identification and facilitation: The role of the State in the dynamics of structural change. Policy Research Working Paper No. 5313. World Bank.

Luanda Entrepreneur Academy (2021). Strategic plan design. Output No. 1: Pre-analysis of entrepreneurial initiatives in the entrepreneurial ecosystem of Luanda.

Lundvall B (1992). *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*. Pinter. London.

McMillan MS and Rodrik D (2011). Globalization, structural change and productivity growth. National Bureau of Economic Research.

Ministry of Agriculture and Fisheries (2020). Agricultural campaign results report 2019/2020. Luanda.

Ministry of Agriculture and Forestry (2019). Agricultural campaign results report 2018/2019. Luanda.

Ministry of Economy and Planning (2018). Production Support, Export Diversification and Import Substitution Programme. Luanda.

Ministry of Higher Education, Science, Technology and Innovation (2014a). Science portal. Available at https://ciencia.ao/noticias/ciencia/item/1170-comunicado-fundacao-para-o-desenvolvimento-cientifico-e-tecnologico-fundecit.

Ministry of Higher Education, Science, Technology and Innovation (2014b). National Centre for Scientific Research. Available at https://www.ciencia.ao/sistema-nacional-de-ciencia/instituicoes-de-investigacao-cientifica-e-desenvolvimento/85-centro-nacional-de-investigacao-cientifica.

Ministry of Higher Education, Science, Technology and Innovation (2018). Statistical yearbook of higher education2018. Luanda.

Ministry of Higher Education, Science, Technology and Innovation (2020). Higher education, scientific research, technology transfer and innovation in Angola: Progress, weaknesses, challenges and opportunities for improvement. Luanda.

Ministry of Telecommunications, Information Technology and Social Communications (2021). White Paper on ICT 2019–2022. Available at https://minttics.gov.ao/ao/livro-branco-das-tic/.

Moretti E (2010). Local multipliers. *American Economic Review*. 100(2):373–377.

Mussamo (2019). Scientific research is not done by order: Interview with the Secretary of State for Science and Innovation of the Ministry of Higher Education, Science, Technology and Innovation.

National Institute for Statistics (2016). *General Population and Housing Census: Final Results 2014*. Luanda.

National Institute for Statistics (2019). *Company Statistics, January*. Luanda.

National Institute for Statistics (2020). *Poverty Report for Angola 2020: Expenditure and Revenue Survey*. Luanda.

National Institute for Statistics (2021). Quick information sheet for national accounts, fourth quarter 2021. Luanda.

National Institute for Statistics (2022). Angola employment survey, May.

Nelson R (1993). *National Innovation Systems: A Comparative Analysis*. Oxford University Press, United Kingdom.

Nyakanini G, Sayinzoga M, Gates N, Almqvist E and Erkan K (2020). *Unlocking the Digital Economy in Africa: Benchmarking the Digital Transformation Journey*. Digital Impact Alliance.

Oman Ministry of Commerce and Industry and United Nations Industrial Development Organization (2019). *Manufacturing for Well-being: Manufacturing Strategy 2040*. Muscat.

Organisation for Economic Co-operation and Development (2022). Aid at a glance charts. Available at https://www.oecd.org/dac/financing-sustainable-development/development-finance-data/aid-at-a-glance.htm.

Ovadia JS (2018). State-led industrial development, structural transformation and elite-led plunder: Angola (2002–2013) as a developmental state. *Development Policy Review*. 36:587–606.

Patel P and Pavitt K (1994). National innovation systems: Why they are important, and how they might be measured and compared. *Economics of Innovation and New Technology*. (3):77–95.

Pinho JC (2017). Institutional theory and global entrepreneurship: Exploring differences between factor versus innovation driven countries. *Journal of International Entrepreneurship*. 2017(15):56–84.

Sers CF and Mughal M (2020). COVID-19[coronavirus disease] outbreak and the need for rice self-sufficiency in West Africa. *World Development*. 135.

Sohn E, Chang SY and Song J (2009). Technological catching-up and latecomer strategy: A case study of the Asian shipbuilding industry. *Seoul Journal of Business*. 15(2).

Spitzer J (2020). Entrepreneurship, small and medium-sized enterprises and special economic zones. Report prepared for the United Nations Industrial Development Organization.

Sustainable Development Solutions Network and Sustainable Development Goals Centre for Africa (2020). 2020 Africa SDG[Sustainable Development Goals] index and dashboards report. Available at https://countries.africasdgindex.org/#/.

The New York Times (2022). Oil prices. Available at https://www.nytimes.com/2022/02/02/business/economy/oil-price.html.

UNCTAD (2008). *Science, Technology and Innovation Policy Review of Angola*.

UNCTAD (2018). *Technology and Innovation Report 2018*.

UNCTAD (2019). *World Investment Report 2019*.

UNCTAD (2020). *Mapping and Assessment Report of the Entrepreneurial Ecosystem in Angola*.

UNCTAD (2021a). *World Investment Report 2021*.

UNCTAD (2021b). *Technology and Innovation Report 2021*.

UNCTAD (2022a). The least developed countries need a new generation of international support measures to face the development challenges of the 2020s. Policy Brief No. 97.

UNCTAD (2022b). *Escaping from the Commodity Dependence Trap Through Technology and Innovation*.

UNCTAD (2022c). *Economic Development in Africa Report 2022*.

United Nations Development Programme and International Labour Organization (2019). The role of professional skills development in the promotion of employment in Angola: A case study from the province of Huila. Luanda.

Van Dam A and Frenken K (2020). Variety, complexity and economic development. *Research Policy*. 51(8).

Ver Angola (2021). Intervention plan in the municipalities executed 200 million dollars. Available at https://www.verangola.net/va/en/012021/Construction/23564/Intervention-plan-in-the-municipalities-executed-200-million-dollars.htm.

Weiss (2015). Taxonomy of industrial policy. Inclusive and Sustainable Industrial Development Working Paper Series No. 8. United Nations Industrial Development Organization.

Weiss (2016). The role of local content policies in manufacturing and mining in low- and middle-income countries. Inclusive and Sustainable Industrial Development Working Paper Series No. 19. United Nations Industrial Development Organization.

World Health Organization (2020). The top 10 causes of death. Available at https://www.who.int/news-room/fact-sheets/detail/the-top-10-causes-of-death.

World Intellectual Property Organization (2021). Global Innovation Index 2021: Tracking innovation through the COVID-19[coronavirus disease] crisis. Available at https://www.wipo.int/publications/en/details.jsp?id=4560&plang=EN.

Wolf C (2017). Industrialization in times of China: Domestic market formation in Angola. *African Affairs*. 116(464):435–461.

World Bank (2018). *Angola: Country Economic Memorandum – Towards Economic Diversification*. Washington, D.C.

Yonazi E, Kelly T, Halewood N and Blackman C (2012). *The Transformational Use of Information and Communications Technologies in Africa*. World Bank and African Development Bank.

Zawya (2021). Angola's special economic zone provides new services to national and foreign investors. Available at https://www.zawya.com/en/press-release/angolas-special-economic-zone-provides-new-services-to-national-and-foreign-investors-mthsaxt4.

Printed at United Nations, Geneva
2305004 **(E)** – March 2023 – 970

UNCTAD/DTL/STICT/2022/7

United Nations publication