Programme for Country Partnership

Industrial Diagnostic Study Rwanda 2020

Acknowledgements

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Executive summary

Rwanda is a country with the ambition of rapidly climbing the ladder of development. According to the National Strategy of Transformation 2017 – 2024 "Vision 2050 aspires to take Rwanda to high living standards by the middle of the 21st century and high-quality livelihoods". Rwanda has made exceptional strides in economic performance. The poverty level has decreased from 77 per cent in 2000 to 55 per cent in 2016. The country's GDP growth rate during the period 2010–2018 has been one of the most dynamic among African countries.

Despite these commendable achievements, the country still faces challenges that may threaten its transition to a higher income level. The share of manufacturing has stagnated at around 6 per cent over the last decades. As highlighted in the literature and reiterated in policy circles, manufacturing is an engine of sustained growth; it has the capacity to create backward and forward linkages, serves as an impulse for innovation and has the capacity to generate economies of scale. A stagnating manufacturing sector may threaten the development process in the medium- to long term.

The PCP (Programme for Country Partnership), which will accompany the Government of Rwanda, UNIDO and all relevant stakeholders over the next few years, is timely for re-igniting the role of manufacturing in the country.

The present study identifies thematic components, priority sectors and bottlenecks to businesses which can guide further discussions on the identification of specific PCP projects. In this context, the NST identifies, among others, agro-processing, meat and dairy, and textiles and garments as sectors that deserve the highest attention. Many of the prerequisites for industries in terms of necessary resources, including natural endowments, human skills and technologies, are available in Rwanda. So far, however, the development of the value chains linking the primary activities (i.e. agriculture and livestock farming) with downstream activities appear to be incomplete. The strengthening of value addition and in particular of transformation activities to strengthen manufacturing represent a first necessary strategic direction for the country. The creation of a component "Integrated value chain development" will be important for reaching this goal.

The development of the manufacturing sector and the related necessary skills and capability are the key prerequisite for the country to capture the opportunities provided by the new wave of technological revolution. The thematic component "Adequate skills for Industry 4.0 and investment promotion for economic diversification" is identified as an important intervention to boost industrialization and sustained growth in the medium- to long term.

The pursuit of industrialization must take energy and environmental aspects into account. The thematic component "Development of sustainable energy" will be essential for matching the growing demand for energy required by industrialization with increased electrification and the production of renewable energy. The introduction of the component "Circular economy for value addition" will accompany the development of transformation and value addition processes, with operations aimed at minimizing waste, using materials for efficient production and minimizing the use of toxic materials.

The design and implementation of projects aimed at boosting inclusive and sustainable industrial development will need to be accompanied by the right industrial policy framework. The overall indicators of policy effectiveness suggest considerable improvements in recent years, and an increased focus on industrial policy through the component "Governance development" could use the momentum of governance improvements to further boost the manufacturing sector.

All the identified thematic components are in line with the objectives and pillars contained in the national policy objectives.

The PCP will not be able to focus on all industries but will instead prioritize interventions in certain manufacturing activities. UNIDO has analysed detailed manufacturing industries based on criteria such as employment, exports and imports, and the capacity of industries to generate employment, to be competitive in international markets and to create policy space for import substitution strategies. The study identifies a set of priority industries (food and beverages, textile, wearing apparel, leather, paper, chemicals, non-metallic minerals, basic metals, motor vehicles, other transport equipment) to be considered in further dialogue following the diagnostic phase on project selection and design. The identified industries are broadly aligned with those flagged in many relevant policy documents. This document also discusses some other industries at a more disaggregated level for each identified priority sector.

The development of value addition activities in the selected priority sectors will depend on the country's capacity to effectively remove the bottlenecks to business for firms. An analysis of the World Bank Enterprise Survey was conducted using firm-level data in the manufacturing sector during three different time periods. The bottlenecks to business that were repeatedly raised by enterprises in Rwanda were further examined. Results show an impressive improvement in many of the examined bottlenecks, reflecting the government's ability to effectively address the main issues. Challenges still remain in terms of access to finance, electricity, skilled labour, tax rate and—for formal firms—competition practices in the informal sector.

This diagnostic report is the first step in the PCP process. In the following post-diagnostic phase, a comprehensive project document will be formulated, and specific projects will be identified and designed, taking the challenges that might hamper the effective process of value addition and of transformation into account.

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INTRODUCTION AND DIAGNOSTIC FRAMEWORK

The present diagnostic study aims to explore Rwanda's challenges and opportunities on the path to industrial development. The study's objective is to provide the PCP programming team and stakeholders with comprehensive yet succinct inputs to successfully design and implement the PCP Rwanda. The report is organized into major sections based on a macro-, meso- and micro-level perspective of the economy (Figure 1)[1].

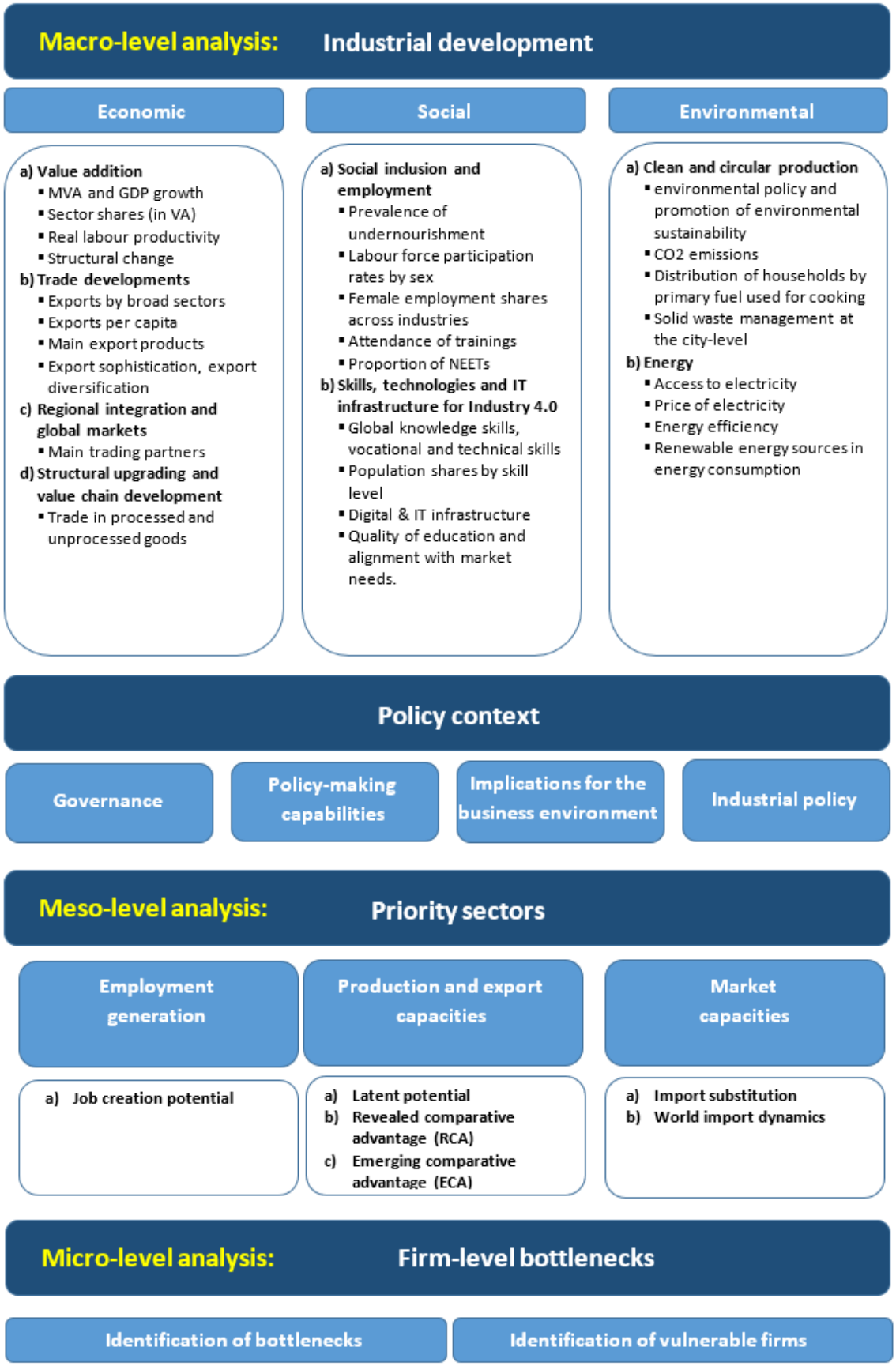
All of the report's analyses link up with Rwanda's national industrialization and broader development objectives. They thus link up with key policy documents, including but not limited to, the National Strategy for Transformation (2017), the Domestic Market Restructuring Strategy (2015) and the National Industrial Policy (2011), which is currently in the process of revision and, importantly, a recent report by the Government of Rwanda produced jointly with the World Bank (2019), which identifies the future growth drivers Rwanda needs to stimulate to achieve the broader development objectives of its Vision 2050, the successor of the current Vision 2020. According to Vision 2050, Rwanda aspires to achieve upper middle-income status by 2035 and high-income status by 2050, which is an average annual growth rate of over 10 per cent.

Against this background, Section 1 takes a macro-economic perspective and analyses Rwanda's economic, social and environmental performance through the lens of an inclusive and sustainable industrial development, the core mandate of UNIDO in line with Sustainable Development Goal (SDG) 9. That is, the ambitious growth and development objective also has a qualitative dimension which requires corresponding human skills, infrastructure and technologies that are fully aligned with the objective of transforming Rwanda into a modern, knowledge-based economy as envisaged in Rwanda's Vision 2020 and confirmed in the subsequent Vision 2050. The latter strives for the transformation of the entire economy and society.

The economic dimension explores, among others, value addition and structural change; export developments, including export diversification and export sophistication; regional integration and global markets and the development of value chains. The social dimension focuses on the inclusiveness of women and youth in the labour market and the development of skills and infrastructure required for the digital transformation and Industry 4.0. The environmental dimension entails the role of waste management and forestry and their potential for domestic value creation, as well as the role of energy, above all, electricity, to achieve Rwanda's industrial development goals. Section 1 concludes by taking a closer look at the overall governance developments and their implications for private sector development.

[1] We acknowledge that the results of the industrial diagnostics may be sensitive 1) to the selected statistical classifications 2) to the concordance tables adopted when needed to prepare trade datasets with a unique statistical nomenclature for analyses 3) to the selected time horizon of the study. The adequacy of the findings is preserved by discussing them with relevant stakeholders.

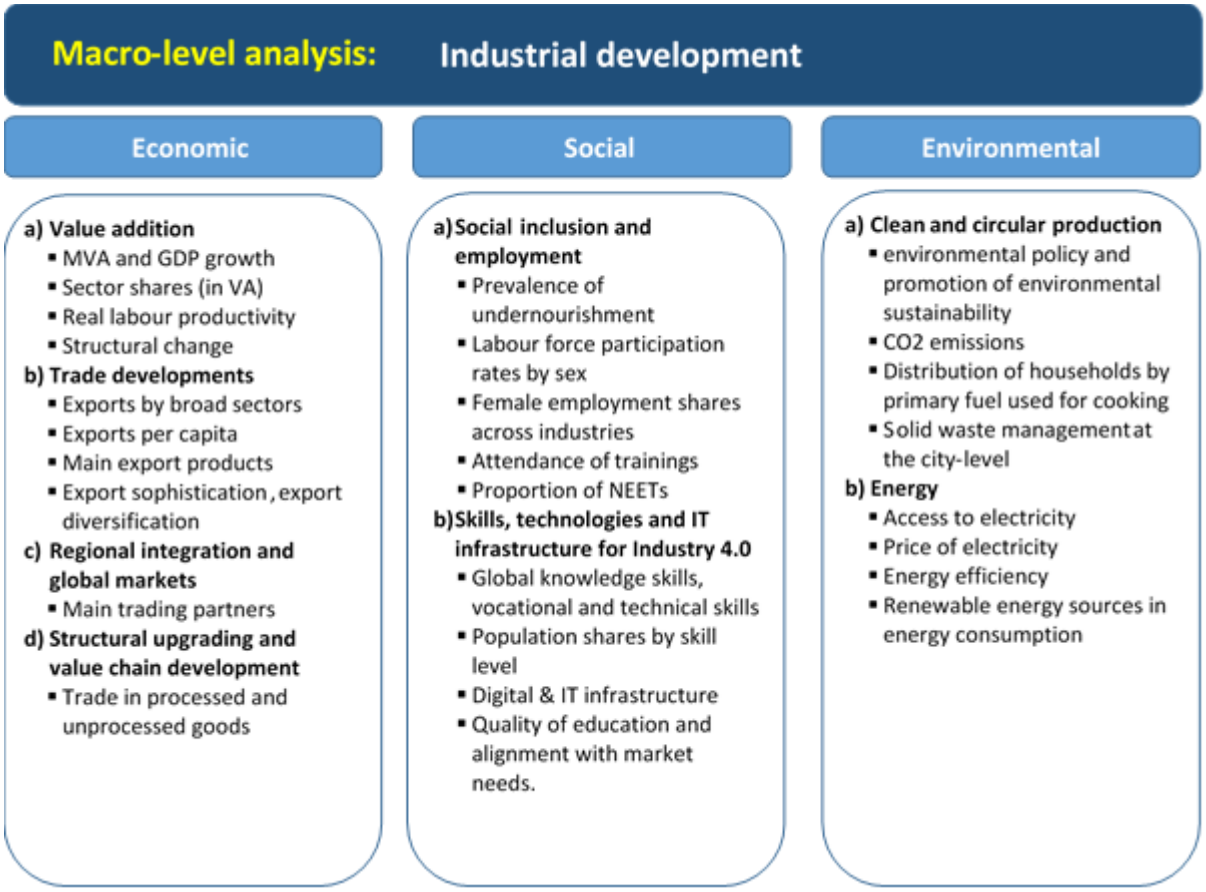
Figure 1: Diagnostic framework for the Programme for Country Partnership (PCP) Rwanda



In Section 2, a meso-level analysis is carried out which identifies potential priority industries on the basis of their revealed comparative advantage, their production potential, level and dynamics of imports as well as their job creation potential. All analyses of priority industries build on existing national policy priorities. Furthermore, specific characteristics of the selected industries are examined.

Section 3 identifies key bottlenecks, the removal of which may provide additional impetus to private sector development. Data from the World Bank Enterprise Survey is used (waves 2006, 2011, and 2019/2020) for this analysis. The firm-level analyses also include a profile of manufacturing firms in the Rwandan economy and the situation of vulnerable firms.

SECTION 1: INDUSTRIAL PERFORMANCE AND POLICY CONTEXT OF RWANDA



I. Economic Performance

a) Value Addition

Overall economic performance

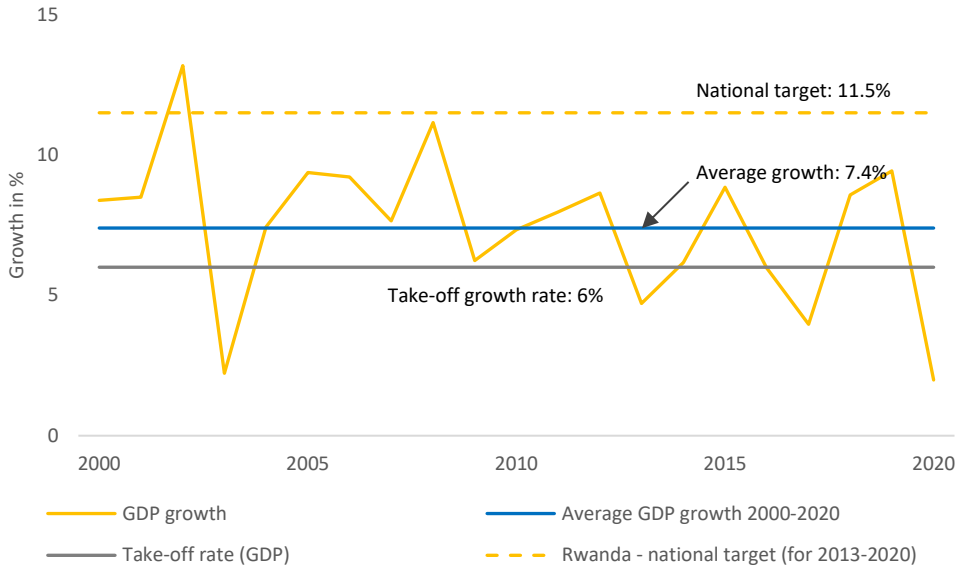
Rwanda is a densely populated, landlocked, low-income country (LIC) in the African Great Lakes Region and one of the fastest growing economies in the world. The country's growth spurt has led to a three-and-half-fold increase in per capita income since 1994 (World Bank and Government of Rwanda, 2019). Within sub-Saharan Africa (SSA), Rwanda's growth performance over the past decade has only been surpassed by Ethiopia.[2] Since the beginning of the new millennium, Rwanda's GDP growth rate has reached 7.4 per cent (Figure 2), which is clearly above the 6 per cent threshold required for a growth take-off (Szirmai, 2012; UNIDO, 2015). The significant drop in the growth rate in 2020 due to the COVID-19 pandemic, while lowering the long-term average growth rate, does not alter this conclusion.

Moreover, the country's growth has been inclusive and has been used, inter alia, for extensive investments in social safety nets which have helped reduce poverty significantly (IMF, 2019). One

[2] Based on average annual GDP growth rates as reported in the World Bank's World Development Indicators (WDI).

positive feature of Rwanda's GDP trajectory is the absence of any major crisis or a growth collapse, which afflict so many developing countries and derail promising catch-up processes (Pritchett, 2000).

Figure 2: GDP growth in Rwanda, 2000–2020



Note: Real GDP growth (in 2015 US dollars). The take-off rate is 6 per cent. Rwanda's national growth target is 11.5 per cent. The average GDP growth rate is the compound annual growth rate.
Source: UNIDO MVA database, Government of Rwanda, 2017, Szirmai, 2012.

Despite this remarkable growth performance, it remains below the very ambitious target of 11.5 per cent for the period 2013–2020 set in the National Strategy for Transformation (NST), the main instrument for implementing the country's development programme Vision 2050 (Government of Rwanda, 2017)[3]. The main objective of Vision 2050 is to transform the country into a knowledge-based economy, to reach upper middle-income status by 2035 and to become a high-income country by 2050 (World Bank and Government of Rwanda, 2019).[4] Achieving the upper middle-income objective requires an average GNI per capita growth rate of 10.5% from 2020 to 2035, which corresponds to an annual growth rate of about 12.5 per cent at the current demographic trend[5]. However, COVID-19 has disrupted Rwanda's economic boom of the past two decades and economic growth dropped to 2 per cent in 2020 (according to UNIDO data). Growth may recover to pre-COVID levels in forthcoming years

[3] Vision 2050 replaced the previous national development programme, Vision 2020, which was launched in the year 2000.

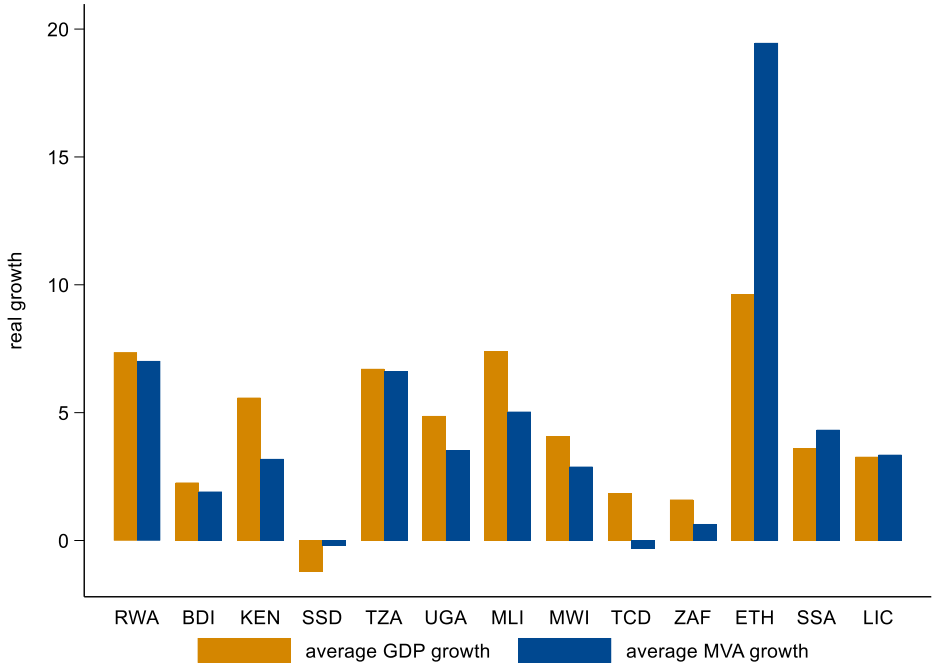
[4] Given Rwanda's gross national income (GNI) per capita (Atlas method) of USD 820 in 2019, the country would reach the 2019 threshold for lower middle-income countries (USD 1,036) in less than 5 years if the average (pre-COVID-19) GDP growth rate of 7.7 per cent (less 2 per cent population growth) could be maintained. By contrast, to reach the World Bank's upper middle-income level of USD 4,046 by 2035, a GNI per capita growth rate of 10.5 per cent would be required (almost equivalent to the needed GDP per capita growth rate ignoring the methodological differences between the Atlas method and the real GDP).

[5] The 2019 threshold for becoming a middle-income country according to the World Bank income classification is a gross national income (GNI) per capita (in current US dollars calculated using the Atlas method) of USD 1,036; the threshold for becoming a high-income country is USD 12,535. Rwanda's GNI per capita in 2019 was USD 820.

(see IMF, 2020) but it is far from certain.[6] In any case, the ambitious development objectives have now become even more challenging.

A comparison of Rwanda's growth rate with its partner countries in the East African Community (EAC) (a customs union between six East African countries that was revived in 2000[7]), other medium-sized, landlocked LIC in SSA, South Africa as the regional leader, and Ethiopia (another fast-growing economy in SSA), confirms that Rwanda has experienced a growth spurt over the last decade (Figure 3). With an average annual growth rate of 7.7 per cent between 2010 and 2019, it grew much faster than the SSA region (3.6 per cent) and the group of all LIC (3.3 per cent), but also outperformed all its EAC partners, including Tanzania (6.7 per cent) and Uganda (4.9 per cent). Only Ethiopia (9.6 per cent) recorded a higher GDP growth than Rwanda, with Mali growing at par (8.3 per cent). Such high growth rates explain why many observers speak of the 21st century as the "African century".[8]

Figure 3: GDP and MVA growth rates in Rwanda and comparator countries, 2010–2019



Note: Real GDP growth (in 205 US dollars).
Source: UNIDO MVA database.

[6] According to the IMF (2020), GDP growth in Rwanda is expected to reach around 6.3 per cent in 2021 and 8.0 per cent in 2022.

[7] The members of the EAC are Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda.

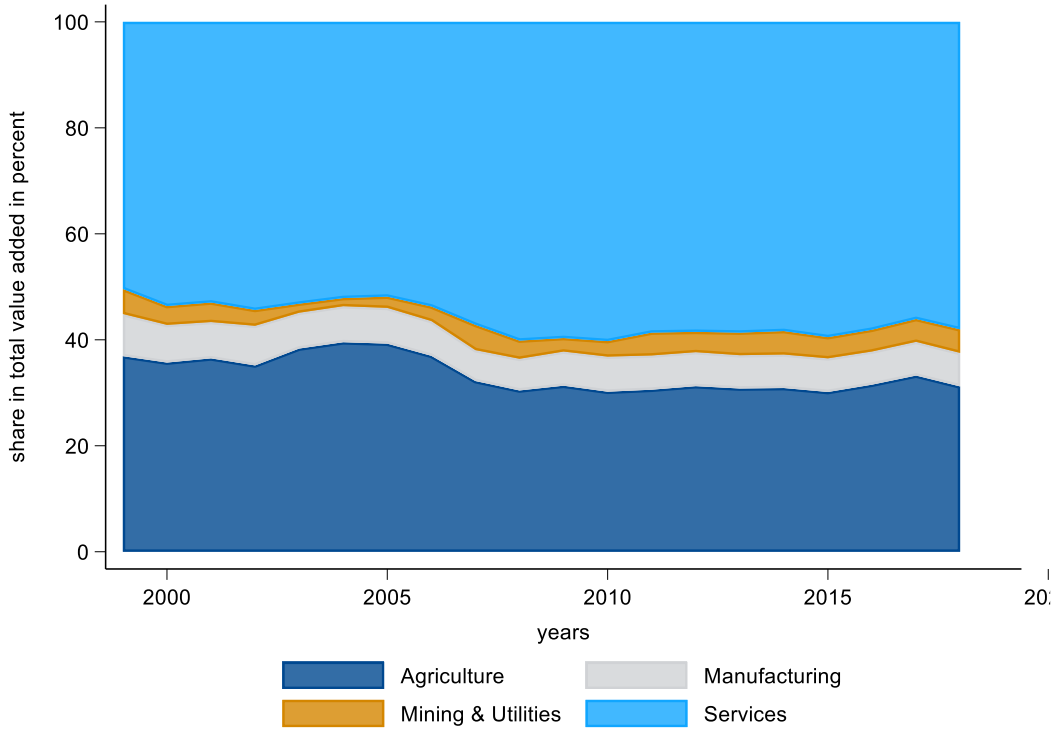
[8] Reference to the African century, which is anticipated to bring peace, prosperity and a cultural revival to Africa, was made, inter alia, by former South African president African Thabo Mbeki in his victory speech in 1999. See: http://news.bbc.co.uk/2/hi/world/monitoring/360349.stm.

Broad sectors and structural development

With a view to the aspired industrial transformation and development, a slight blemish in Rwanda's otherwise impeccable growth record since 2000, is that its real manufacturing value added (MVA) growth rate, while impressive, fell short of the economy-wide growth dynamics. In comparison with other SSA countries, Rwanda's real MVA growth of 7 per cent is relatively high, and comparable to that of Tanzania. Overall, the performance of the Rwandan manufacturing sector is considered to have been subpar (World Bank and Government of Rwanda, 2019). The experiences in comparator countries show that an MVA growth rate below that of GDP (as observed in Rwanda) is a common pattern in many low-income SSA countries (and in LICs, in general) whose economies are dominated by (subsistence) agriculture, mining activities and increasingly, services. Ethiopia, however, illustrates that manufacturing-led growth is also feasible in sub-Saharan LICs when appropriate policies are in place. The development and expansion of 'modern' sectors—essentially all parts of the economy apart from subsistence agriculture and informal activities, such as petty traders—is crucial as the entire process of development is rooted in the transformation of the production structure and its underlying capabilities (see, e.g. Chang, 2010). Traditionally, the transformation of the production structure has been associated with industrialization, implying a shift of production factors (mainly labour) from (subsistence) agriculture to manufacturing and other modern industries characterized by high levels of productivity (see, e.g. Cimoli et al., 2009; Reinert, 2007). This shift in the production structure directly contributes to the country's growth and is known as a 'structural change bonus' (Timmer and Szirmai, 2000).

Against the background that Rwanda's strategy for high growth is based on four essential and interdependent drivers—innovation, integration, agglomeration and competition (World Bank and Government of Rwanda, 2019)—a structural shift towards manufacturing appears expedient as manufacturing is the source of most innovations, features strong agglomeration effects and is characterized by a high degree of economic integration, leading to stronger competition. While Rwanda's growth strategy follows a multisectoral approach that does not rely alone on manufacturing as a driver of growth (World Bank and Government of Rwanda, 2019), the strengthening of the, until now, underdeveloped manufacturing sector is undoubtedly warranted. Over the past two decades, the share of manufacturing in total value added has stagnated at just above 6 per cent, so that the decline of the share of agriculture has been reflected in an expansion of the services sector from 50 per cent in 2000 to 58 per cent in 2019 (Figure 4). The pace of structural change in the Rwandan economy has been slow overall in terms of value added. The downside of this is that the potential aggregate productivity gains induced by structural change is not being fully exploited. At the same time, the fairly stable economic structure might also reflect a 'balanced growth' experience across all sectors.

Figure 4: Value added shares of main economic sectors, Rwanda, 2000–2019



Note: Shares of sectors are based on nominal values. Construction is subsumed under services.
Source: UN National Accounts statistics.

Agriculture. The agricultural sector accounted for 31 per cent of total value added in 2018 (see Figure 4). Given the country's demographic trend, the sector continues to absorb additional workers, who are almost entirely informally employed, with a large share employed in subsistence agriculture (NISR, 2018)[9]. Agriculture, albeit characterized by low labour productivity, therefore remains the backbone of Rwanda's economy (see also AfDB, 2014), accounting for 63 per cent of total employment in 2019[10].

Due to its economic and social importance, Rwanda's NST defines agriculture as one of its priority sectors (Government of Rwanda, 2017), and hence as one of the key economic drivers with the potential of significantly contributing to job creation and productive employment. Given its size, the agricultural sector is central to Rwanda's overall growth trajectory, and its ambitious growth targets will require significant improvements in productivity. These should come from investments to improve farming methods, including the adoption of climate resilient techniques and stronger value chain linkages with domestic and export markets. The need for value chain development towards agro-

[9] According to Rwanda's Labour Force Survey (LFS) of 2018, 99.6 per cent of all persons employed in agriculture are informally employed; 41 per cent of agricultural employees participated in subsistence agriculture in 2018 (NISR, 2018). Moreover, many persons employed in other industries in the economy also participated in subsistence agriculture.

[10] This figure is taken from the ILO's World Employment and Social Outlook (WESO) database, available at https://www.ilo.org/shinyapps/bulkexplorer28/?lang=en&segment=indicator&id=EMP_2EMP_SEX_ECO_NB_A. These data are also reported in the World Bank's World Development Indicators (WDI), but differ significantly from Rwanda's national LSF survey data. The ILO estimate, however, is similar to the number indicated by the FAO. See: http://www.fao.org/rwanda/our-office-in-rwanda/rwanda-at-a-glance/en/.

processing activities is also warranted by the fact that arable land is scarce in Rwanda (Hausmann and Chauvin, 2015). Hence, creating jobs in non-land-intensive activities is necessary.

As Rwanda is dominated by highlands, with the lowest altitude in the country 950 m above sea level, it is estimated that 90 per cent of domestic cropland is on slopes ranging from 5 per cent to 55 per cent.[11] This topography limits the potential for large-scale agriculture. The most productive crops include plantains, cassava, potatoes, sweet potatoes, maize and beans. The cultivation of tea and coffee, products that are also important export items, is of particular relevance. In the marshlands, where water is abundant, rice and vegetables are cultivated. Grazing of livestock is another major activity, also primarily for subsistence purposes. Hides and milk are also produced for the market and exported.

Mining and utilities contribute around 4 per cent to total value added (see Figure 4), with about half of that, i.e. 2 per cent, attributable to the mining sector.[12] While this is a modest share, the sector is important for the generation of export revenues and as the base for the development of resource-based manufacturing industries. For example, in June 2019, Rwanda acquired its first-ever gold refinery, which is located in the Kigali Special Economic Zone in the Gasabo District. Given the strong increases in the price of gold, the precious metal is believed to have considerable development potential, and in 2019, became the country's main export item, surpassing other minerals such as tin and tantalum. The latter is a rare mineral, with Rwanda belonging to the top producers, accounting for around 9 per cent of the world's tantalum used in electronics manufacturing.[13] Other mineral resources exported by Rwanda include cassiterite, coltan, wolfram, peat and nickel.

Manufacturing. Rwanda's manufacturing sector is still small and undiversified (AfDB, 2014), accounting for around 6 per cent of the country's total value added with a slightly negative trend. Until recently, the manufacturing sector played a marginal role in Rwanda's development strategy (Behuria, 2019). According to Behuria (2019), officials from the Ministry of Trade and Industry and the Ministry of Finance and Economic Planning were pessimistic about the manufacturing sector's growth potential, as high transportation costs impede Rwanda from developing competitive manufacturing industries. Therefore, the National Industrial Policy launched in 2011 (Ministry of Trade and Industry, 2011), which called for import substitution to reduce the large trade deficit, but did not propose any major action (Behuria, 2019). The importance assigned to the manufacturing sector increased with the Domestic Market Recapturing Strategy (DMRS) of 2015 (Ministry of Trade and Industry, 2015), a supplement to Rwanda's industrial policy, which aims to combine export-oriented industrial development and import substitution. The renewed interest in the manufacturing sector is also reflected in the country's (revised) Special Economic Zones Policy (Ministry of Trade and Industry, 2018), designed to address the country's remaining (but decreasing) infrastructure constraints, and its open trade policy, which is designed to overcome the limited domestic market size, and is geared, in particular, towards regional integration within the EAC and beyond.

[11] Information from the FAO. See: http://www.fao.org/rwanda/our-office-in-rwanda/rwanda-at-a-glance/en/.
[12] According to data from the NISR, available at: https://www.statistics.gov.rw/.
[13] See website of the Rwanda Development Board (RDW): https://rdb.rw/export/export/products-directory/mining-sector/.

Similar to other low-income countries, Rwanda's modest manufacturing sector is dominated by resource-based manufacturing industries. In fact, as of 2012 MVA was generated in only seven subsectors: food; beverages and tobacco; textiles and clothing; wood, paper and printing; chemicals[14], rubber and plastics; non-metallic minerals; and furniture (AfDB, 2014). Food, beverages and tobacco account for the lion's share of manufacturing output (AfDB, 2014, Calabrese et al. 2017). One surprising feature of Rwanda's manufacturing structure, given its endowments of tin, gold and other natural resources, is the marginal role played by the mineral and metal industries. This points to the unused potential of low skill-intensive industries that Rwanda could try to tap into in the future.

Over the past two decades, the growth of MVA at 7.6 per cent has not only remained below the economy-wide growth, but also significantly below the industrial sector's policy target of 14 per cent for 2013–2020, as set in the NST.

Services. The services sector consists of a large set of relatively heterogeneous industries ranging from comparatively low value added activities, such as construction services and retail sales, to modern business services, such as information and communication technology (ICT), finance and business services. The development of the services sector has until recently been perceived by the government as a way to transform the economy into a modern, knowledge-based economy, leapfrogging manufacturing. While the assessment of what are considered leading industries has—at the latest since the introduction of the Domestic Market Restructuring Strategy (Ministry of Trade and Industry, 2015)—slightly shifted in favour of manufacturing, the government is determined to develop comparative advantages in numerous modern service industries, including banking and finance, with the aspiration of making Kigali a regional financial hub, to promote health care tourism and higher education (World Bank and Government of Rwanda, 2019). Moreover, there might also be interesting niches in traditional service industries. For example, within the tourism industry, Rwanda has been very successful in developing conference tourism.[15]

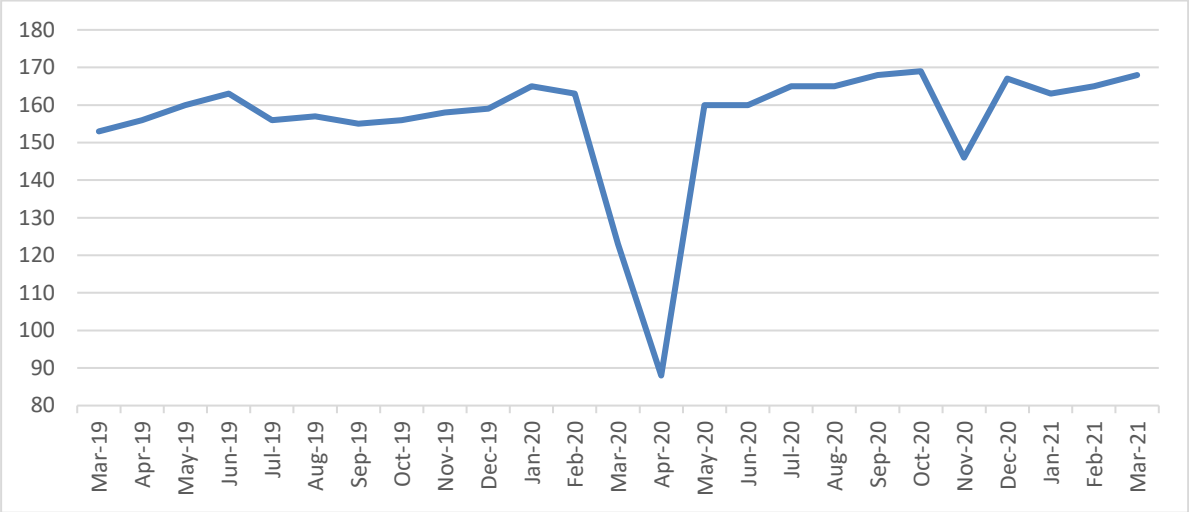
In addition to the transformational potential of individual service industries, the service sector is important because it is by far the largest sector (in value added terms) and has almost exclusively been absorbing the resources freed in agriculture (Figure 5).

[14] These mainly consist of basic chemicals such as fertilizers (see Hausmann and Chauvin, 2015).
[15] Information obtained from consultations with stakeholders.

Box 1: The COVID pandemic and industrial policy

The current pandemic is jeopardizing the economies of many developing countries. As emphasized by a recent UNIDO COVID bulletin[1], countries with a lower level of income are exposed to the pandemic's economic risks through different channels: 1) a higher level of contagion reduces the availability of workers to work and produce; 2) global recession may reduce demand for goods from countries experiencing GDP contraction; 3) the pandemic may disrupt value chains, as the production of technology-intensive components, especially in high-income countries, might drop; 4) lower prices for raw materials (e.g. a reduction of the oil price) may decrease the revenue of primary goods exporters. Containment measures (e.g. the shutdown of businesses) may also have a negative impact on economic performance.

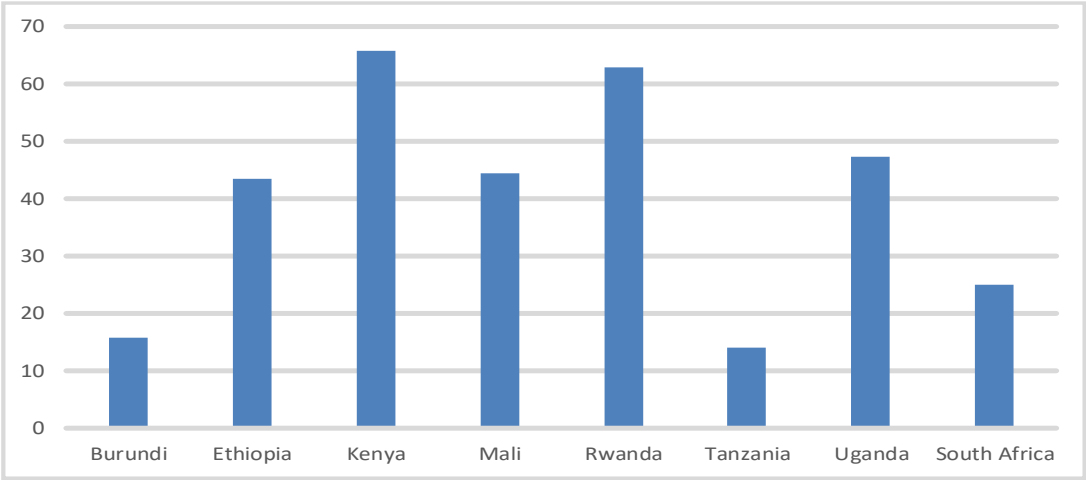
Figure B1.1: Index of industrial production in Rwanda



Source: UNIDO IIP dataset https://stat.unido.org/database/Monthly%20IIP

Compared to the levels in December and March 2019, Rwanda has registered a significant drop in the index of industrial production followed by an encouraging rapid recovery. This index is an indicator that represents the volume of production of industrial goods based on the IIP value = 100 in the 2015 the base year.

Figure B1.2: COVID policy stringency index in Rwanda and comparator countries



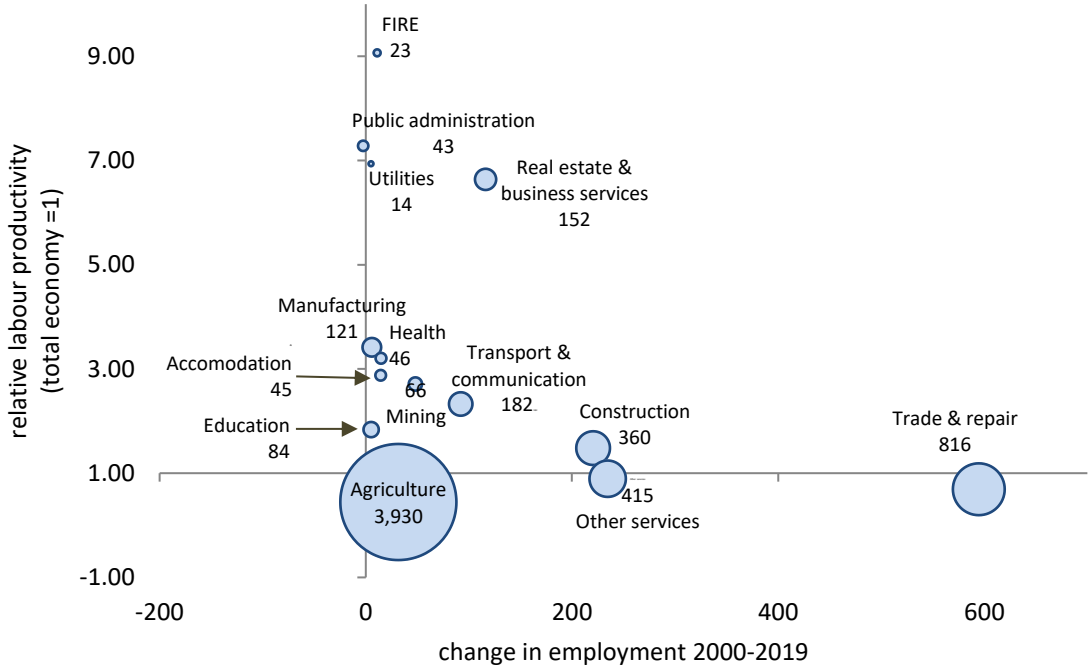
Source: https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker#data. Data referring to 31/5/2021.

An indicator of COVID policy stringency assesses the proactiveness of governments in addressing COVID from a containment, economic response, and health system perspective[2]. This indicator does not determine whether countries are responding successfully, but only specifies the level of stringency of their policies. According to this index, Rwanda is characterized by a high level of activism in containing the pandemic and in designing economic responses.

Even though the PCP is a medium-term programme, it could represent a good opportunity to study potential interventions from an industrial policy perspective, which can help mitigate economic growth losses by continuing to preserve the health objectives.

Notes : [1] https://www.unido.org/stories/coronavirus-economic-impact-10-july-2020
[2] https://www.bsg.ox.ac.uk/sites/default/files/2020-09/BSG-WP-2020-032-v7.0.pdf

Figure 5: Structural change in Rwanda, 2010–2019



Note: Labour productivity is based on nominal value added data from the fiscal year 2018/2019. Employment data (from the ILO) are model estimates. The bubble size indicates the size of the industry in terms of employment (in thousands). Employment change is also expressed in thousands. FIRE includes the finance and insurance sectors and the real estate sector. A labour productivity of 1 indicates that the industry has the same level of labour productivity as the economy-wide average. Higher values indicate higher productivity.
Source: NISR GDP database, ILO database, authors' own calculations.

Figure 5, however, also reveals that the service industries that have taken up the overwhelming majority of employees over the past decade are low-productivity segments, such as trade and repair services (816,000 additional persons) or other services (415,000 additional persons). Most of the additional workforce did not flow in from agriculture or any other sector, but is explained by the growth of the labour force per se.

The fact that employment generation within the service sector, while crucially important, primarily takes place in low-productivity industries suggests that leapfrogging manufacturing to accelerate

development is interesting theoretically but is de facto difficult to realize. The Domestic Market Recapturing Strategy (DMRS) of 2015 as well as the NST, therefore, place stronger emphasis on the development of the manufacturing sector. Importantly, propping up development efforts in manufacturing does not come as an alternative to the expansion of modern services, but as a complement. After all, it is the manufacturing sector that provides the necessary demand for many professional, scientific and technical services as well as other business services, including banking and ICT services. One of the manufacturing sector's key advantages is its relatively high productivity compared to other parts of the economy. In the case of Rwanda, labour productivity in manufacturing is about three and a half times higher than that in the overall economy. So far Rwanda's manufacturing sector has been unable to create a significant number of new jobs. A stronger contribution of the manufacturing sector to economic growth and employment generation would address many of the priorities specified in the NST's economic transformation objective, in particular the promotion of industrialization per se and a structural shift in the export base towards higher value added products; the creation of 214,000 decent and productive jobs annually and the build-up of a globally competitive knowledge-based economy (Government of Rwanda, 2017, p. viii).

Labour productivity in the manufacturing sector

As is the case for the overall economy, the manufacturing sector's productivity is retained by the high prevalence of informal employment, amounting to 94 per cent according to the national LSF survey (NISR, 2018). The labour productivity gains achieved since 2010 have allowed Rwanda to catch up with other EAC countries such as Tanzania and Uganda, but the country remains far below the level of South Africa (Figure 6, panel a). The latter is a particularly useful benchmark for Rwanda's ambitious manufacturing development objectives. The current situation, however, also reveals that the country still has a long way to go to catch up even with the regional productivity frontier. Yet this assertion is not specific to manufacturing but is also true for the labour productivity gaps at the level of the economy (Figure 6, panel b).

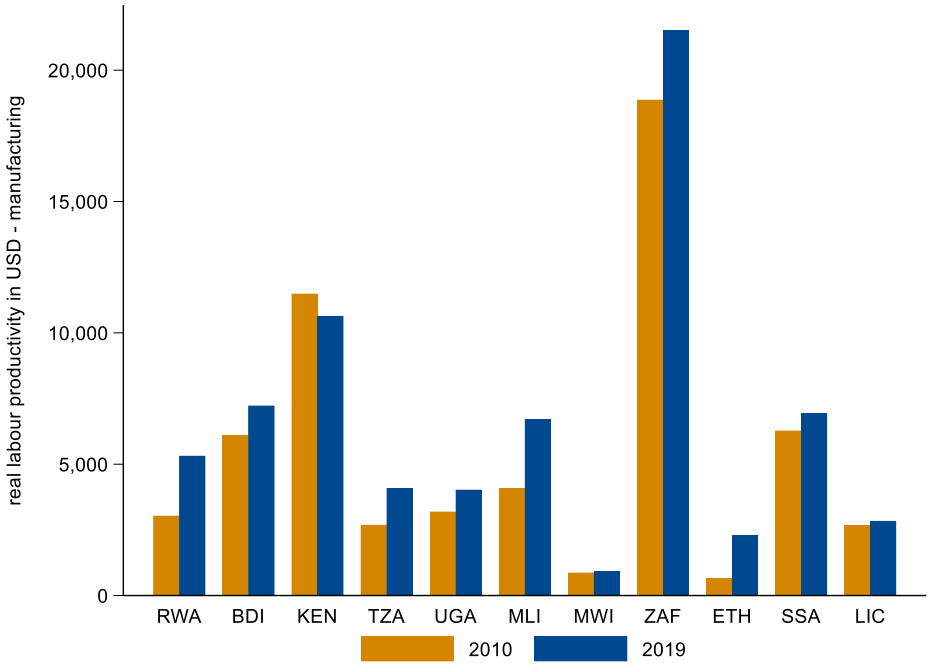
The Secretariat of the Sector Working Group on Private Sector Development and Youth Employment Strategy (PSDYES) (2017) identified low capacity utilization rates, amounting to 65 per cent of the manufacturing sector's installed capacity; lack of access to buyers; unreliable supply of inputs and a lack of working capital (33.3 per cent) as key sources of inefficiencies, which in turn keep productivity levels low.[16] All of these elements, which tend to be mutually reinforcing, are potential areas for additional policy support. The value chain approach enshrined in the government's NST appears to be highly suitable for ensuring that efficiency improvements in the value creation process are not undermined by remaining obstacles in some segment of the value chain, despite substantial efforts in numerous other segments. Against the background of financial resource constraints, an integrated value chain development approach, which potentially requires numerous interventions across various value chain segments, ideally targets a limited number of priority industries. Rwanda has, amongst others, identified agro-processing as well as textiles and garments as priority sectors (Government of

[16] The key bottlenecks that prevent firms from achieving further advances in productivity are discussed in detail in Chapter 3.

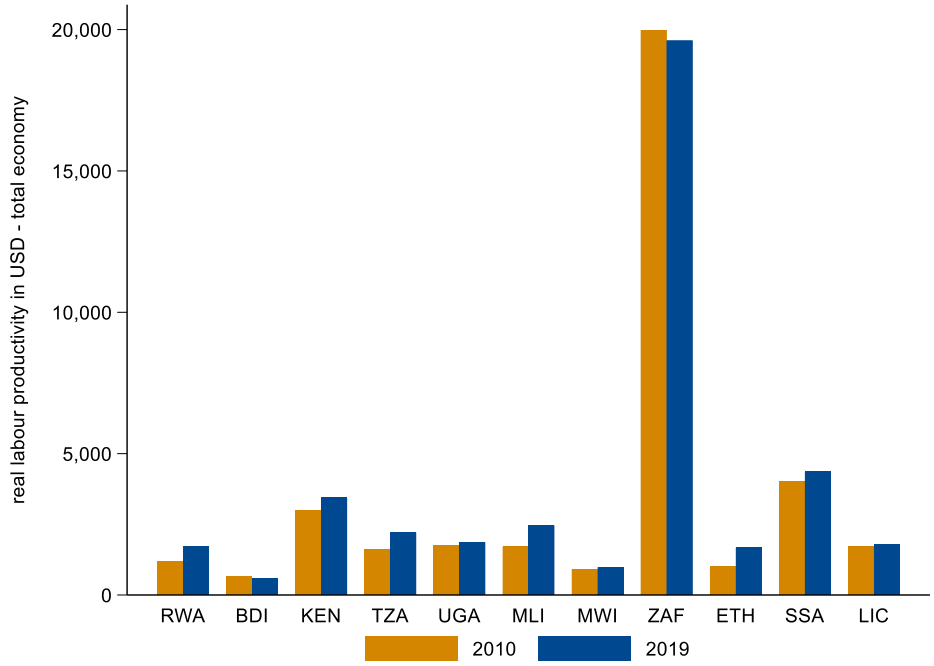
Rwanda, 2017). These two sectors account for the lion's share of Rwanda's MVA, which makes the development of value chains within them crucial for overall manufacturing development.

Figure 6: Real productivities in Rwanda and competitor countries, 2010 vs 2019

(a) Manufacturing



(b) Total economy



Note: Real values (in 2015 US dollars). Employment data (from the ILO) are model estimates.
Source: UNIDO MVA 2020 database, ILO database.

Since an integrated value chain approach needs to take all potential cost and quality factors within and beyond the boundary of the firm into account (ranging from input sourcing to actual production

processes and technologies, to transportation and logistics or access to foreign markets), both the integrated agro-processing and textile and wearing apparel value chains can be considered to be cross-cutting thematic components. The need for structural upgrading in these priority sectors is discussed further below.[17]

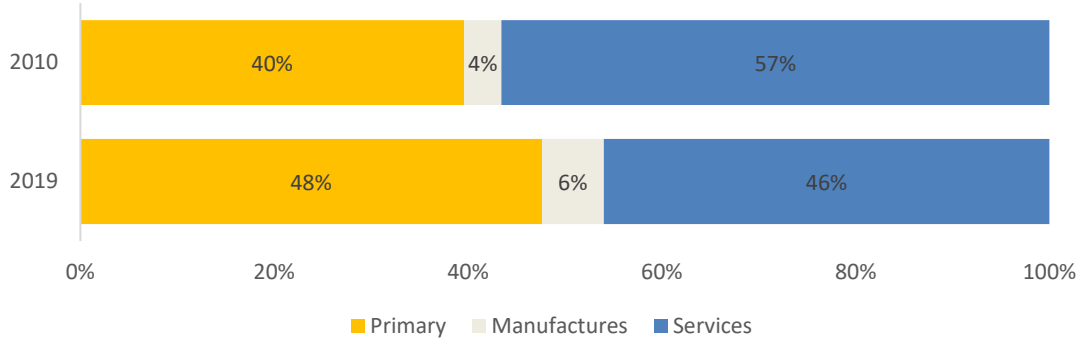
Improvements in productivity and structural upgrading are obviously a prerequisite for gaining international competitiveness beyond primary products and minerals, which in turn supports efforts by the Rwandan government to reduce the substantial trade deficit.

b) Trade developments

Export competitiveness

A key characteristic of successful industrializers is an export structure that is dominated by manufactured goods.[18] This is obviously not the case in Rwanda, which predominantly exports primary products and services, while manufactured exports only accounted for 6 per cent of the country's total exports in 2019.

Figure 7: Rwanda's export structure, broad sectors. 2010 vs 2019

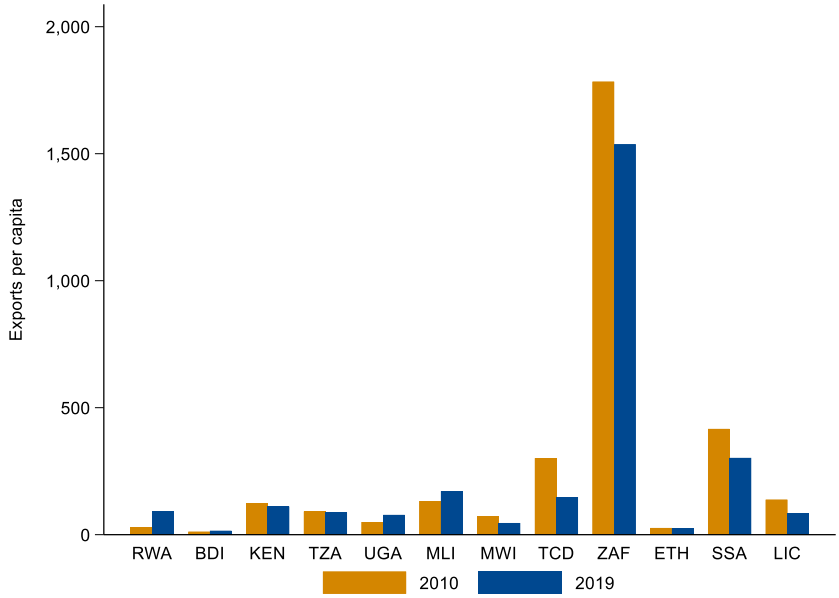


Note: Definition of manufacturing goods is borrowed from the World Trade Organisation series: 'manufacturing' defined as 'Merchandise exports by product group' and 'services' as 'Balanced International Trade in Services'. The primary sector calculated as merchandise goods less manufactured goods.
Source: WTO Trade Database.

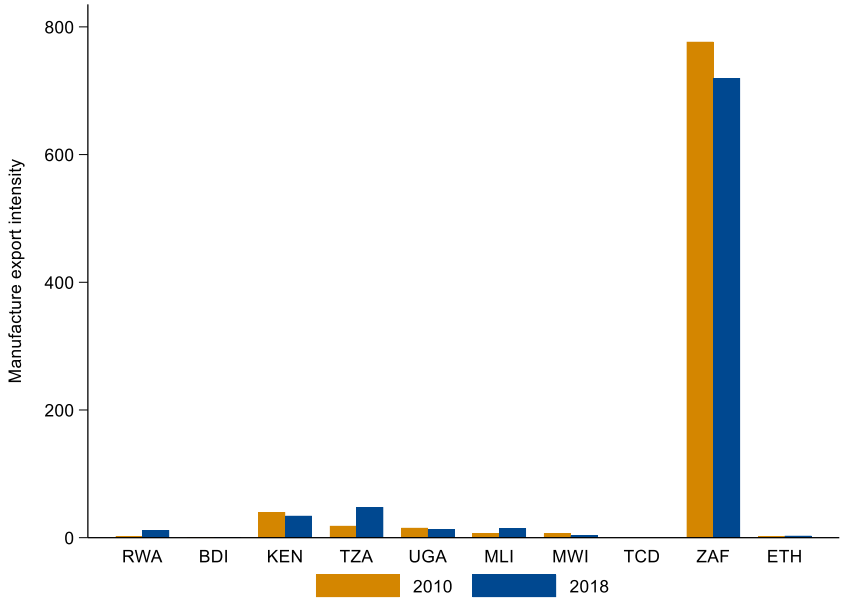
[17] The appropriateness of selecting these industries is fully confirmed by the detailed analysis in Chapter 2.
[18] This is due to the fact that the manufacturing sector produces (i) highly tradable output; (ii) features important economies of scale, and (iii) is less likely to run into demand constraints than primary products (see Szirmai, 2012).

Figure 8: Exports per capita in Rwanda and competitor countries, nominal USD

(a) Total merchandise exports, 2010 vs 2019



(b) Manufactured exports, 2010 vs 2018



Note: Panel (a): 2019 data for Tanzania and Malawi are from 2017 (last data available). Data for South Sudan are not available. Panel (b): Data for South Sudan, sub-Saharan Africa and low-income countries are not available. The definition of manufacturing goods is borrowed from the World Trade Organisation https://www.wto.org/english/res_e/statis_e/technotes_e.htm. Data on services trade for Rwanda are only available until 2013.

Source: WTO Trade Database, World Bank WDI.

The fact that the low share of manufactured exports is not attributable to the exceptional performance of services exports is revealed by Rwanda's comparatively low export intensity[19] (Figure 8, panel a). The upside to this is a strongly positive trend, with export intensities rising from USD 30 in 2010 to USD 92 in 2019. This means that Rwanda has successfully defied the more general negative trend that prevails in most countries in the EAC region (apart from Uganda) as well as in the wider SSA region and in the group of LICs. More precisely, manufacturing export intensity increased by 13.5 per cent annually, on average – a remarkable performance considering that Rwanda's population has been growing at around 2 per cent per year.[20] At the same time, Rwanda still has a long way to go if it is to close the gap to the leading industrial power in Africa in terms of export intensity, i.e. South Africa. As of 2019, South Africa's export intensity exceeded Rwanda's by a factor of nearly seventeen times.

The status quo development of Rwanda's manufacturing export intensity is in many respects similar to that of overall merchandise exports: it remains at a very low level, namely USD 12 (as of 2018), but grew dynamically after 2010, with an average annual growth rate of 18.5 per cent, outperforming all other countries in the ECA region. Again, the distance to South Africa is large, but the export intensity's dynamic development signals that there must be a potential for many industries to also become competitive in the manufacturing sector.

Export diversification and sophistication

A transformation process with a structural upgrading component requires not only a quantitative expansion of exports but typically also a qualitative improvement of the export structure. Rwanda currently has a very narrow export base that is strongly dominated by animal and mineral products, and reflects the key role of agriculture in the economy (Table 1). Typically, the list of the top five export products account for between 75 per cent to 80 per cent of total goods exports and does not include any manufactured products.

Despite the strong concentration of exports in primary products, it is also true that exports have become significantly more diversified and more sophisticated (Figure 9).[21] While Rwanda clearly started from a relatively low level of both export diversification and export sophistication, the situation improved considerably between 2010 and 2019. Specifically, exports became significantly more diversified, as measures by the Herfindahl-Hirschman Index (HHI), which dropped from 0.15 (2010) to 0.07 (2016). It is also remarkable that Rwanda is the only country in the EAC region that simultaneously managed to (i) diversify its exports, (ii) increase its level of export sophistication (from 8.8 in 2010 to 9.2 in 2018), and (iii) increase the share of manufactured exports in total exports, which rose from 8 per cent in 2010 to 18 per cent in 2019 (indicated by the size of the bubble in Figure 9).

[19] Export intensity in this context refers to nominal merchandise exports per capita.

[20] Inflation does not change this result as the relatively volatile inflation rate was even slightly negative, on average, over the period 2010–2019. Hence, the positive trend is confirmed by the data on real manufacturing value added per capita.

[21] According to a commonly used measure for the level of sophistication of a country's export basket that is based on the export products' exclusivity (i.e. a low number of countries exporting it). For details, see Hausmann et al. (2007).

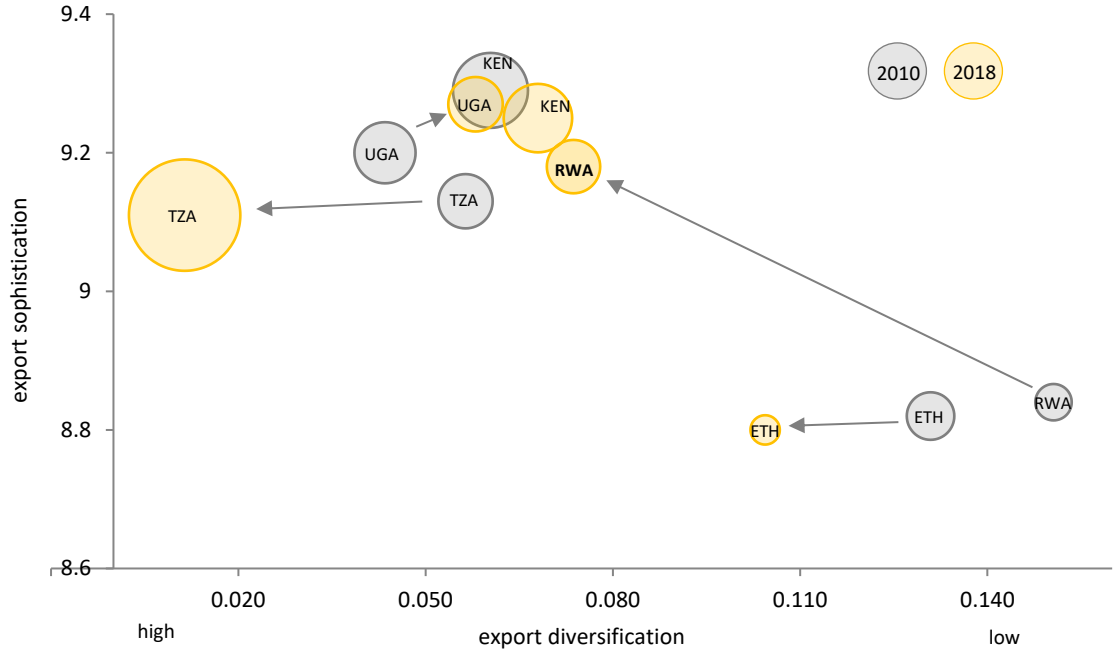
Table 1: Rwanda's main export products, 2010, 2017, 2018

Rank	Product	Product group	Export share (% goods exports)	Exports (mn USD)	RCA
		Year: 2018			
1	Gold	Precious metals	65.62	636.5	39.6
2	Niobium, tantalum, vanadium and zirconium ore	Mineral products	7.91	76.7	745.2
3	Coffee	Vegetable products	6.85	66.4	40.8
4	Tin Ores	Mineral products	6.26	60.7	2000.7
5	Tea	Vegetable products	5.78	56.1	137.8
	Top 5		92.42	896.4	
		Year: 2017			
1	Coffee	Vegetable products	26.8	60.0	143.7
2	Tea	Vegetable products	21.63	48.4	495.4
3	Niobium, tantalum, vanadium and zirconium ore	Mineral products	17.59	39.4	2112.0
4	Tin ores	Mineral products	6.41	14.3	2225.8
5	Tungsten ore	Mineral products	3.43	7.7	3779.3
	Top 5		75.86	169.8	
		Year: 2010			
1	Coffee	Vegetable products	26.36	90.9	162.5
2	Tin ores	Mineral products	24.73	85.3	6800.7
3	Niobium, tantalum, vanadium and zirconium ore	Mineral products	15.74	54.3	1760.8
4	Tea	Vegetable products	9.11	31.4	218.3
5	Tungsten ore	Mineral products	2.99	10.3	2206.2
	Top 5		78.93	272.2	

Note: RCA= revealed comparative advantage. The revealed comparative advantage is an index representing the ratio between the share of country´s sector exports in total country exports and the share of world sector exports in total world exports. A value of the index higher than 1 flags a specialisation of a country in a certain sector bigger than at world level.
Source: Observatory of Export Complexity (based on data from CEPII's BACI database).

As mentioned above, all of these positive trends may be partly attributable to a base effect, but it nevertheless adds a positive qualitative element to the positive quantitative trends. The comparison with other EAC members clearly demonstrates that these improvements are by no means a general trend in the region. Neither Tanzania (which has a higher GDP per capita) nor fast-growing Ethiopia, for example, managed to increase their level of export sophistication. Kenya and Uganda, on the other hand, witnessed a loss of export diversification.

Figure 9: Export development in Rwanda and EAC partner countries, 2010 vs 2018



Note: The bubble size indicates the share of manufactured goods exports (according to SITC) in total exports. Export diversification is the normalized Herfindahl-Hirschman Index (HHI) which ranges from 0 to 1. Export sophistication is the EXPY measure developed by Hausman et al. (2007). In contrast to the other two indicators, the later period of the HHI refers to the year 2019 (instead of 2018), except for Rwanda, where the last available year is 2016. Export sophistication for Tanzania is the year 2015 (instead of 2018). The HHI is calculated at the HS 6-digit level for all export products. The level of export sophistication is expressed in logs.
Source: UN Comtrade (downloaded over WITS) using the Trade Outcomes Indicators tool.

This generally positive trend could indicate that the basic framework condition that enables product upgrading and diversification in resource-based and labour-intensive manufacturing industries is a promising route for a more dynamic industrial development process in line with the country's policy objectives.

c) Regional integration and international markets

As a landlocked and relatively isolated country that is far from any major markets, Rwanda has an intrinsic interest in regional integration. The country has therefore actively pursued further regional integration efforts. This includes, above all, the development of the common market within the EAC, with the lowering of common external tariffs, the promotion of harmonized standards in goods and services and the removal of remaining non-tariff barriers (NTMs) being key priorities (World Bank and

Government of Rwanda, 2019).[22] Rwanda also supports the development of the Common Market for Eastern and Southern Africa (COMESA), a pan-African free trade area comprising over 20 member states. Furthermore, a joint report by the UN Economic Commission for Africa and Trademark East Africa (2020) suggests that further advances towards regional integration would provide substantial benefits for the economies of East Africa. A comprehensive African Continental Free Trade Area (AfCFTA), which entails the liberalization of goods and services trade, is estimated to increase intra-African exports by more than USD 1.1 billion and welfare by USD 1.8 billion. Related employment opportunities will mainly emerge in labour-intensive industries and could also support economic diversification in the region as the manufacturing sector is likely to be a key beneficiary of such an agreement (UN Economic Commission for Africa and Trademark East Africa, 2020).

While the importance of EAC partners as destinations for exports have diminished over time (Table 2), they are still a major source of imports, accounting for nearly 20 per cent of imports. Moreover, regional integration, which is a stated objective of the NST, is more important for Rwanda than suggested by trade statistics, as it depends on EAC partners for access to seaports, notably Mombasa (Kenya) and Dar es Salaam (Tanzania).[23] Cooperation with EAC partners is also key for the development of regional value chains, which Rwanda could strongly benefit from (World Bank and Government of Rwanda, 2019), in particular, to secure the required inputs (such as cotton in the textile industry), but also as outlets for manufactured goods to benefit from economies of scale. One important partner country is neighbouring DR Congo, which is Rwanda's primary destination for manufactured goods, which absorbs some 37 per cent of Rwanda's total manufactured exports. This situation is partly explained by the usual 'gravity factors', that is, geographic proximity and the DR Congo's market size. Another part of the explanation may also be that the DR Congo is a relatively easy export market.

Rwanda's trading partners have changed considerably over time, especially in terms of export markets, when in 2019, the United Arab Emirates became Rwanda's main export partner, which is related to increased gold exports. Gold has potential as an export item, especially because of the new gold refinery[24] located in the Kigali Special Economic Zone (SEZ) in Gasabo District.[25] A contentious issue in this context, however, could be the sourcing of the raw material, as Rwanda's own raw material reserves are clearly insufficient for the gold refinery's capacity.

[22] The remaining NTMs are one of the key reasons why trading across borders is perceived as being a major obstacle to doing business in Rwanda (see Section IV).
[23] Information obtained from consultations with stakeholders.
[24] The project is a joint venture between Hilly Metals Company and the Rwandan company Aldabra.
[25] See: https://www.newtimes.co.rw/news/rwanda-gold-refinery.

Table 2: Rwanda's main trading partners, total goods and manufactured exports, 2010 vs 2019

	Share in % of total	Trade value (USD mn)		Share in % of total	Trade value (USD mn)
2019	**Exports, total**		**2019**	**Imports, total**	
United Arab Emirates	43.7	341.5	China	19.9	635.3
DR Congo	7.9	62.0	India	8.8	280.5
Switzerland	6.9	53.7	Kenya	8.7	278.5
Pakistan	5.0	39.1	Tanzania	8.4	269.7
United Kingdom	4.8	37.6	United Arab Emirates	7.6	244.1
Singapore	3.8	29.7	Saudi Arabia	4.8	152.3
Uganda	3.6	28.3	South Africa	3.9	124.1
Burundi	3.5	27.0	Switzerland	3.6	114.2
South Sudan	2.5	19.8	Germany	2.9	92.8
Kenya	1.5	11.7	Turkey	2.4	75.1
World	*100.0*	*780.8*	*World*	*100.0*	*3,195.2*
Sub-Saharan Africa	*20.8*	*162.2*	*Sub-Saharan Africa*	*27.2*	*867.9*
East African Community	*11.6*	*90.3*	*East African Community*	*18.5*	*590.4*
2010	**Exports, total**		**2010**	**Imports, total**	
Kenya	18.9	38.9	China	15.0	211.3
Switzerland	18.0	37.1	Uganda	12.7	178.9
Belgium	13.0	26.7	Kenya	10.1	142.2
Hong Kong	9.3	19.2	India	5.5	77.2
China	8.5	17.6	Tanzania	5.4	75.9
DR Congo	7.9	16.3	Japan	5.3	74.1
United Kingdom	5.3	10.9	United Arab Emirates	5.1	71.2
USA	3.6	7.4	Belgium	3.6	50.6
Uganda	2.8	5.8	USA	3.3	46.4
Eswatini	2.1	4.3	Germany	3.0	42.8
World	*100.0*	*206.0*	*World*	*100.0*	*1,405.2*
Sub-Saharan Africa	*36.3*	*74.7*	*Sub-Saharan Africa*	*34.1*	*479.7*
East African Community	*24.7*	*50.8*	*East African Community*	*28.4*	*399.1*
2019	**Exports, manufactured**		**2019**	**Imports, manufactured**	
DR Congo	36.9	23.8	China	32.5	585.6
United Arab Emirates	15.3	9.9	India	11.4	205.5
Burundi	8.0	5.2	Kenya	9.3	168.5
Uganda	5.8	3.8	Tanzania	5.9	106.0
USA	4.9	3.2	United Arab Emirates	5.0	90.3
Belgium	4.7	3.0	Germany	4.1	73.1
United Kingdom	3.7	2.4	Turkey	3.3	60.0
France	2.8	1.8	South Africa	2.5	44.8
China	2.2	1.4	USA	2.2	40.3
Tanzania	1.9	1.2	Belgium	1.7	30.2
World	*100.0*	*64.6*	*World*	*100.0*	*1,803.8*
Sub-Saharan Africa	*61.1*	*39.5*	*Sub-Saharan Africa*	*19.6*	*352.8*
East African Community	*17.9*	*11.6*	*East African Community*	*16.6*	*299.1*

Note: For 2010, the East African Community figures exclude South Sudan.
Source: UN Comtrade (downloaded over WITS). Authors' own calculations.

d) Structural upgrading and value chain development in priority sectors

With the share of agriculture accounting for roughly one-third of domestic value added and two-thirds of employment, the need to structurally upgrade Rwanda's economy towards activities with a high potential for value added creation is obvious. However, such a structural transformation process is not set in motion automatically but requires active policy support. Rwanda's NST as well as numerous

other policies such as the Made in Rwanda Strategy (2011) or the DMRS (2015), take account of this fact and highlight the need to develop entire value chains.

Table 3: Rwandan trade by processing stage, 2010 vs 2019

(a) Trade in primary and processed food and beverages

	Exports				Imports			
	primary	processed	primary	processed	primary	processed	primary	processed
	(% of total food and beverages)		(% of total food and beverages for industrial use)		(% of total food and beverages)		(% of total food and beverages for industrial use)	
2010	90.1%	9.9%	95.4%	4.6%	21.3%	78.7%	23.8%	76.2%
2017	71.7%	28.3%	60.3%	39.8%	22.4%	77.6%	38.5%	61.6%
2018	74.5%	25.5%	59.6%	40.4%	27.1%	72.9%	42.9%	57.1%
2019	68.1%	31.9%	55.8%	44.2%	25.1%	74.9%	43.3%	56.8%

(b) Trade in coffee

	Exports			Imports		
	unroasted	roasted	values	unroasted	roasted	values
	in % of total coffee		in USD '000	in % of total coffee		in USD '000
2010	100.0%	0.0%	55,690	27.9%	72.1%	37
2017	99.5%	0.5%	64,580	92.6%	7.4%	35
2018	99.7%	0.3%	70,257	99.4%	0.6%	2,757
2019	99.8%	0.2%	69,811	99.8%	0.3%	423

(c) Trade in industrial supplies (excluding capital goods)

	Exports		Imports	
	primary	processed	primary	processed
	(% of total food and beverages)		(% of total food and beverages)	
2010	91.1%	8.9%	83.7%	16.3%
2017	71.3%	28.7%	90.1%	9.9%
2018	74.7%	25.3%	89.0%	11.0%
2019	25.9%	74.1%	92.6%	7.4%

Note: Panels (a) and (b): classification by Broad Economic Categories (BEC). Panel (c): Coffee includes product categories 0711 coffee, not roasted, and 0712 coffee, roasted, according to SITC 3 classification. Values refer to nominal values in thousands USD.
Source: UN Comtrade (downloaded over WITS). Authors' own calculations.

In this context, the NST identifies agro-processing, meat and dairy, and textiles and garments as priority sectors, among others. These sectors are well identified as many of the prerequisites in terms of required resources, including both natural endowments, human skills and technologies, seem to be available in Rwanda. So far, however, the development of value chains linking primary activities (i.e. agriculture and livestock farming) with downstream activities appears to be incomplete. And just like a chain is only as strong as its weakest link, a value chain is often only as efficient as its biggest bottleneck allows. Hence, a shortcoming along a value chain tends to make downstream products and activities uncompetitive. This becomes evident in Rwanda's export profile by processing stage.

Although the trend points towards processed products, Rwanda still exported nearly 70 per cent of its food and beverages as primary products, that is, unprocessed in 2019 (Table 3, panel a). At the same time, three-quarters of imported food and beverages constitute processed goods, which points to the

potential for import substitution that is likely to be present, as not all agricultural imports can be assumed to be non-competing imports. As emphasized in Rwanda's DMRS, import substitution is not to be achieved by shielding domestic industries from foreign competition by raising tariffs, but by making Rwandan producers internationally competitive, an objective that is echoed in Rwanda's industrial policy which is currently in the process of being updated.

Panel (b) of Table 3 shows that the export of products in their raw form is also represented in major export items such as coffee. Essentially, all of Rwanda's coffee is exported in unroasted form. The fact that imports of roasted coffee are minor indicates that Rwanda has roasting capacities at its disposal, but they seem to be used for domestic coffee consumption only – presumably due to a lack of international competitiveness. Making the downstream value chain activities, including roasting, packaging and ideally also branding, internationally competitive—in line with Rwanda's export strategy and the "Made in Rwanda" strategy—would open up new potential for value added and employment generation.

The described export profile geared towards primary exports is also found in numerous other industrial supplies (Table 3, panel c), hence the development of value chains emerges as a key element in Rwanda's industrial development strategy with a substantial potential for employment generation. Given the importance of structural upgrading for Rwanda's economy, and the identification of the food and beverages industry (associated with agro-processing) and the textiles and wearing apparel industry as priority sectors (see Chapter 2), the development of value chains for the agro-processing and textiles and garments industries, although industry-specific and not of a cross-cutting nature, emerge as strategic priorities.

One of the major challenges for the textile and wearing apparel industries, which have also been defined as an industrial policy priority, are the fragmented value chains (along with limited skills) and have so far prevented these industries from fully unleashing their potential for job and value added creation (World Bank and Government of Rwanda, 2019). However, the step-up in support measures since 2015 developed by the Rwanda Development Board, the National Industrial Research and Development Agency of Rwanda (NIRDA) and the Ministry of Trade and Industry, which provided land in specialized industrial parks to various textile and wearing apparel industries, has led to a significant acceleration of the industries' overall job creation and export growth rate (World Bank and Government of Rwanda, 2019). Therefore, the industrial policy approach applied to the textile and wearing apparel industries could serve as a broader model for industrial policy, including the attraction of foreign direct investment.

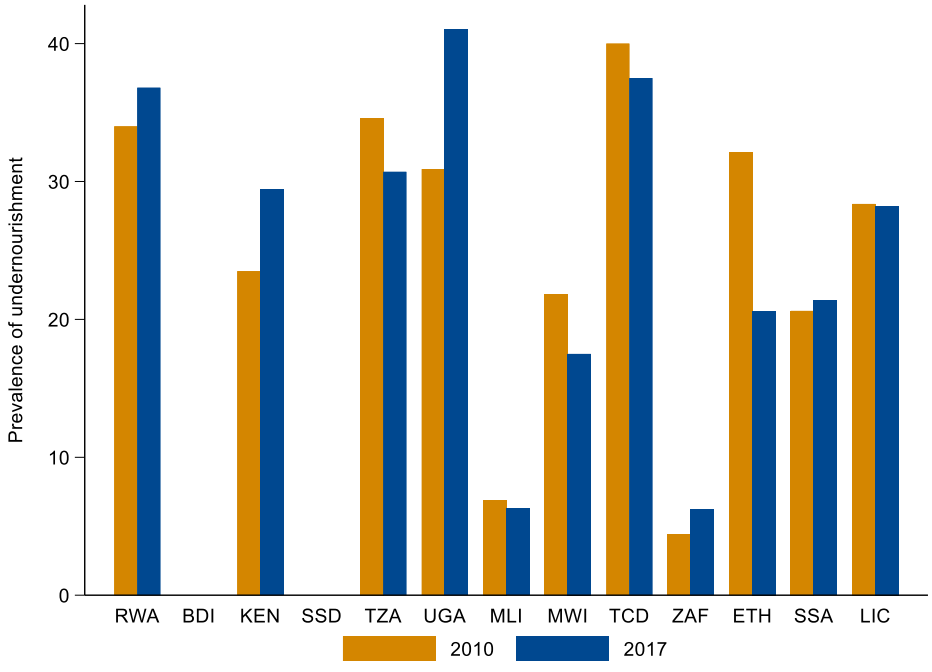
II. Social Performance

a) Social inclusion and employment

Poverty, inequality and undernourishment

With the impressive growth rate Rwanda has recorded over the past two decades, the country has also been able to reduce poverty and significantly extend the life expectancy of its—predominantly very young—population (World Bank and Government of Rwanda, 2019). Hence, Rwanda's economic development features many aspects of an inclusive and pro-poor growth process. Despite this social progress, major challenges remain. About half of the population still lives in extreme poverty,[26] and a moderately high Gini coefficient (44 in 2016) indicates that inequality must be monitored as well. The fact that according to internationally comparable data, the prevalence of undernourishment among the population has not diminished is surprising as well (Figure 10). On the contrary, between 2010 and 2017, a slight increase to 37 per cent was recorded. This development counteracts the decline in poverty rates and could possibly also point to logistical difficulties within the country. In any case, a comparatively high rate of undernourishment confirms, on the one hand, the need to focus on the development of reliable supply chains, including transportation and logistics, and the choice of agro-processing as a priority industry (see Chapter 2) and a thematic component, on the other, as it may have wider social implications.

Figure 10: Prevalence of undernourishment in Rwanda and in competitor countries, 2010 vs 2017



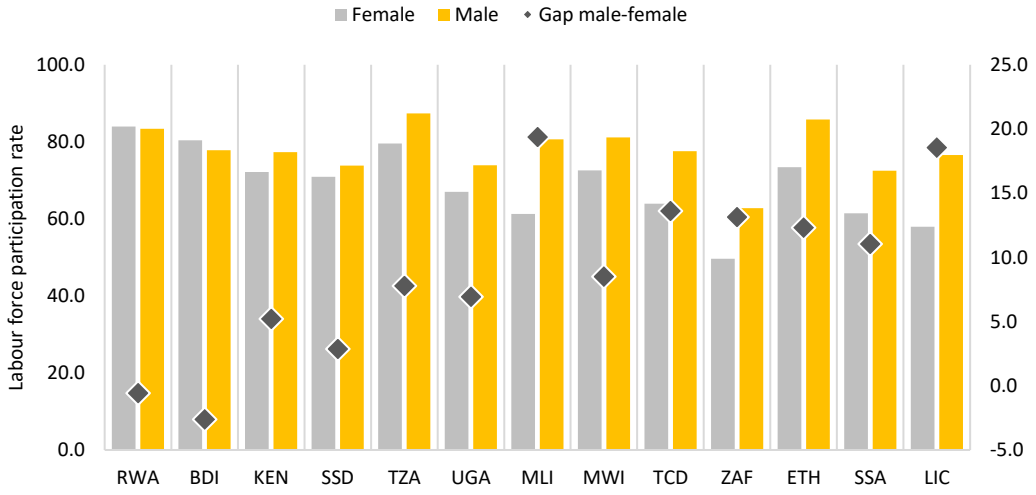
Note: The prevalence of undernourishment in per cent of the total population. Data for Burundi and South Sudan not available
Source: World Bank WDI.

[26] Applying the World Bank's ceiling for extreme poverty of USD 1.90, 56 per cent of Rwandans lived in extreme poverty in 2016.

Participation of women and youth in the labour market

An important component of inclusion is the active participation of both sexes in social and economic life. In post-genocide Rwanda, women made up an estimated 60 per cent to 70 per cent of the population, which can be deemed as one of the contributing factors that led the country to follow a deliberate policy of empowering women, which is constitutionally backed.[27] This policy has had a genuine impact, with women now holding 64 per cent of seats in the lower house of Rwanda's parliament. School enrolment rates at the primary and secondary levels are comparable for both girls and boys; maternal and infant mortality has dropped significantly, and Rwanda has also achieved one of the highest rates of female labour force participation, not only in Africa, but in the world (Figure 11). In fact, with a female labour force participation of 83.9 per cent in 2019, there is even a negative male-female gap.

Figure 11: Labour force participation rates in Rwanda and competitor countries, 2019

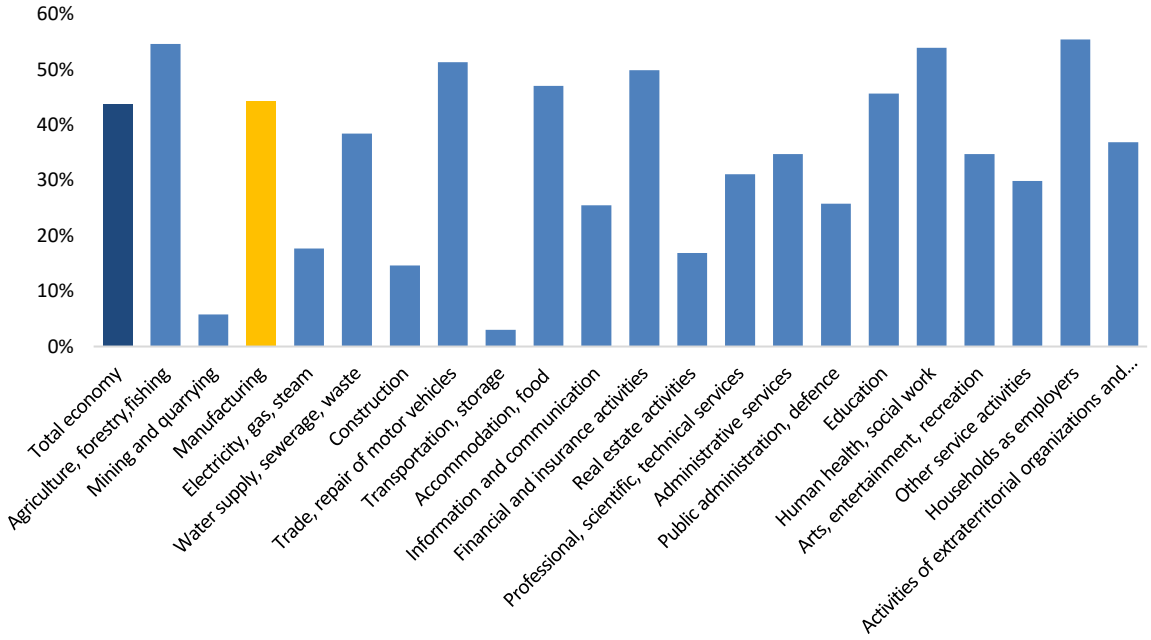


Note: The gap is the difference between the male and the female labour participation rate (population 15 years and above).
Source: ILO database (obtained via the World Bank's WDI).

Women are also well represented across a large number of industries, with the overall female employment rate in the economy standing at 44 per cent (Figure 12). Women are clearly overrepresented in agriculture, wholesale and retail sale services and health services. The share of female employment in manufacturing equals that of the economy as a whole, which is important as it indicates that a more manufacturing-led development process is going to offer new job opportunities of women in the Rwandan economy.

[27] See: "A mixed tale of women's empowerment in Rwanda", Al-jazeera, 20 September 2018. Available at: https://www.aljazeera.com/indepth/features/mixed-tale-women-empowerment-rwanda-180918131311419.html.

Figure 12: Share of female employment across industries in Rwanda, 2018



Note: Population 16 years or older.
Source: NISR (Rwanda Labour Force Survey).

Having said this, there is room for improvement of gender issues in Rwanda. On the downside, Rwanda is still perceived as a patriarchal society[28] which, among others, implies a relatively segmented labour market which is masked in the general sectoral employment patterns, but is reflected in the available data on trainings attended (Table 4). Such a segregation also exists *within* the manufacturing sector, which consists of typically 'female industries' or jobs and 'male industries' or jobs. The number of men and women who participate in technical training, available by occupation, clearly demonstrates this. What is of relevance for the manufacturing sector is that tailors, who are typically employed in the textile and wearing apparel industries, are typically female,[29] which implies that women would benefit more proportionately from an expansion of these industries. The same is true for the food and beverages as well as agro-business trainings,[30] which are predominantly attended by women as well. By contrast, technically-oriented occupations, such as mechanics or carpentry, are male-dominated. This occupational gender divide needs to be kept in mind when discussing new technologies and the transition to Industry 4.0.

[28] See: "A mixed tale of women's empowerment in Rwanda", Al-jazeera, 20 September 2018. Available at: https://www.aljazeera.com/indepth/features/mixed-tale-women-empowerment-rwanda-180918131311419.html.
[29] This is observable not only in Rwanda, but is a typical pattern across developing countries and beyond.
[30] This may be less true for livestock herding and associate activities.

Table 4: Number of persons attending trade and technical training in Rwanda, 2018

Technical skills acquired	Total	Share of females
Total persons in training	**1,102,444**	**45.0%**
Crop production	1,135	100.0%
Housekeeping	196	100.0%
Manicure and pedicure	286	100.0%
Crochet embroidery	44,963	92.0%
Tailoring	345,940	90.9%
Biding and jewelleries	9,247	90.5%
Beauty therapy	2,873	84.9%
Pottery	3,866	76.5%
Culinary arts	50,491	75.5%
Hairdressing	58,171	74.8%
Agri-business	1,662	65.7%
Food & beverage services	7,919	64.2%
Milk processing	434	56.2%
Front office	4,951	54.0%
Multimedia	627	53.4%
Food processing	3,090	49.1%
Leather crafts	3,155	44.9%
Animal health	1,636	43.0%
Software development	5,348	39.9%
Livestock	1,765	38.1%
Sport and medical massage	452	25.9%
NCDs and palliative care community health	1,020	25.9%
Other	13,482	25.4%
Nursery growing	661	20.3%
Forestry	314	17.2%
Plumbing	6,279	16.7%
Film making	3,797	15.6%
Civil engineering	6,294	14.7%
Computer maintenance	5,037	13.7%
Painting and decoration	5,827	10.6%
Industrial electricity	4,086	10.6%
Domestic electricity	36,577	10.6%
Motor vehicle engine mechanics	13,261	5.1%
Automotive technology	13,850	4.6%
Masonry	249,237	4.0%
Auto - electricity	1,059	3.7%
Carpentry	82,207	2.8%
Automotive body repair	65,292	2.2%
Welding	26,508	1.0%
Engine mechanics	15,363	0.4%
Music	1,695	0.0%
Networking	774	0.0%
Concrete masonry	425	0.0%
Agriculture mechanization	65	0.0%
Bee keeping	104	0.0%
Screen printing	1,025	0.0%

'female' occupations

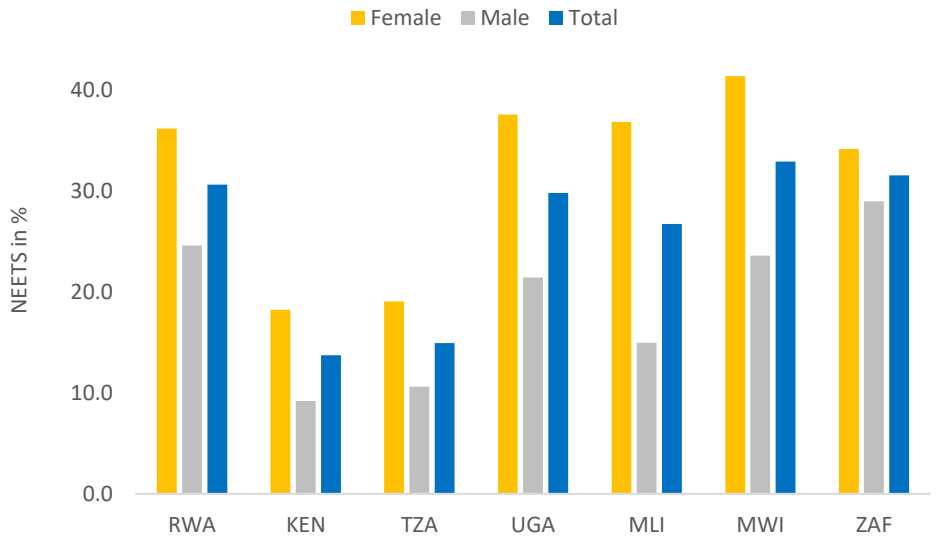
'male' occupations

Note: Population 16 years or older.
Source: National Institute of Statistics of Rwanda (NISR) – National Labour Force Survey for 2018.

Another potentially vulnerable group in the labour market are young people, as the lack of previous experience often makes it more difficult for them to find a job. This problem is obviously aggravated in an environment where formal jobs are rare so that the only alternative for earning a living are often informal activities, such as petty trade or (subsistence) agriculture. One result is that the youth unemployment rate is generally higher than in the overall working age population. This is also the case in Rwanda, where the unemployment rate stood at 18.7 per cent according to the National Labour Force Survey (LFS) of 2018, a rate that has certainly increased since then due to the COVID pandemic. What is more telling than the unemployment rate about the labour market opportunities of young people is the share of youth, i.e. persons aged 15–24 years old, that are neither employed nor in education (NEETs). In Rwanda, NEETs account for about one-third of youth, with the share of females being even higher (*Figure 13*). This share of NEETs is in line with figures observed in many other African countries, but is substantially higher than in neighbouring Kenya and Tanzania. The relatively high rate of NEETs is just another indicator that Rwanda has not yet fully unleashed the potential of its young population.

It is also true, however, that a considerable share, namely 28 per cent, of Rwanda's working age population continue their education either at the university level (12 per cent) or undergo some trade or technical training (16 per cent),[31] mainly at vocational schools; or an apprenticeship and on-the-job training, and only to a lesser extent through friends or family. This demonstrates that an active vocational training system is in place in the country, though its capacity may not be sufficient to provide a place for all people seeking training.

Figure 13: Share of NEETS in Rwanda and comparator countries, 2018



Note: NEETs= Persons aged 15–24 years who are not in education, employment or training.
Source: ILO database based on national sources.

[31] Data is taken from the National Labour Force Survey of 2018, available from the National Institute of Statistics of Rwanda (Tables 6 and 11).

b) Adequate skills for Industry 4.0 and investment promotion for economic diversification

The term Industry 4.0 originates from the German High-Tech Strategy[32] and has since become a general term for either preparing and/or successfully embracing the new production technologies associated with the Fourth Industrial Revolution.[33] The latter is characterized by cyber-physical production systems that aim to connect the physical and digital world of production, resulting, among other things, in digitally connected manufacturing processes. Industry 4.0 can be described as an industrial revolution involving an entire range of new technologies. By fusing the physical, digital and biological worlds, it will have an impact on all disciplines, economies and industries, and challenge ideas about what it means to be human (Schwab, 2017). These technologies include, but are not limited to, blockchain technologies, artificial intelligence (AI), advanced robotics and machine learning robotics, additive manufacturing (3-D printing), nanotechnology, biotechnology, quantum computing and the Internet of Things (IoT) (*Figure 14*).

Figure 14: Key technologies for embracing Industry 4.0

Note: SOP = Standard Operating Procedure; ERP = Enterprise Resource Planning; SCM = Supply Chain Management; MES = Manufacturing Execution System; CRM = Customer Relationship Management.
Source: Boston Consulting Group (2016).

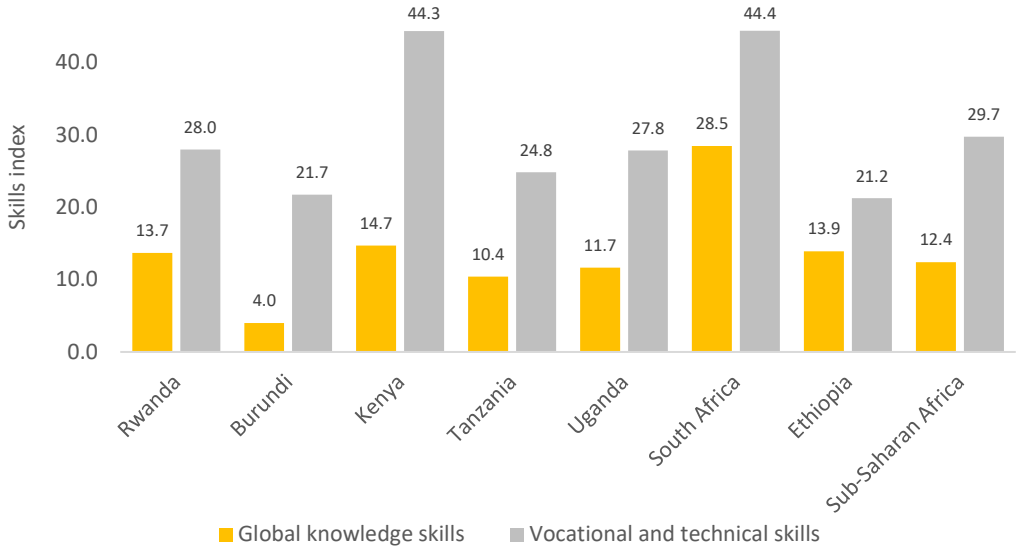
As pointed out in UNIDO's latest edition of the Industrial Development Report (UNIDO, 2020), preparedness for the digital transformation and engagement in Industry 4.0 technologies requires specific skills in the labour force and the development of capabilities in the manufacturing sector. The development of the manufacturing sector and preparedness for the new technological revolution are two sides of the same coin. New technologies are a double-edged sword for developing nations as they can, depending on the respective country's preparedness, enable leapfrogging and faster economic

[32] Industry 4.0 referred to a *Project for the Future* of the German Government initiated in 2011 and developed into a platform in 2013. See: https://www.bmbf.de/de/zukunftsprojekt-industrie-4-0-848.html

[33] The previous industrial revolutions were the steam-based industrial revolution in the early 19th century, the electricity-based Second Industrial Revolution at the end of the 19th and early 20th century, and the Third Industrial Revolution of the 1970s, which brought about automation and digitalization (PwC, 2016).

catch-up or, in the absence of basic capabilities, skills and institutions, raise additional barriers to convergence. To unfold their potential, advanced digital production technologies require complementary skills. These 'skills of the future' can be grouped into three categories, namely (i) analytical skills, (ii) specific technology-related skills, which include science, technology, engineering and math (STEM) skills and ICT-related skills, and (iii) soft skills. In the Global Talent Competitiveness Index (GTCI) (INSEAD, 2020), an attempt is made to accurately measure such skills and talents, differentiating between vocational training skills and global knowledge skills.[34] As *Figure 15* illustrates, East African economies, including Rwanda, do not score high in vocational and technical skills and even less in global knowledge skills. There is a significant gap even to the regional leader, South Africa, both with respect to vocational training skills and global knowledge skills.

Figure 15: Global knowledge skills and vocational and technical skills in Rwanda and competitor countries, 2020



Note: *VT Skills = vocational training skills* include (i) mid-level skills, which are based on GTCI scores for the workforce with secondary education; population with secondary education; technicians and associate professionals; labour productivity per employee; and (ii) employability which is based on GTCI scores for relevance of the education system to the economy; skills matching with secondary education; skills matching with tertiary education. *GK Skills = global knowledge skills* include (i) high-level skills based on GTCI scores for the workforce with tertiary education; population with tertiary education; professionals; researchers; senior officials and managers; availability of scientists and engineers; and (ii) talent impact based on GTCI scores for innovation output; high-value exports; new product entrepreneurial activity; new business density; scientific journal articles.
Source: Global Talent Competitiveness Index (GTCI).

The gap to the African technological frontier is confirmed by more conventional data on skills from Rwanda's National Labour Force Statistics (Figure 16). As of 2019, over 80 per cent of Rwanda's working age population only has basic skills or less than basic skills. While this skill structure is quite common across EAC partner countries and other African economies, the differences to South Africa are obvious. Equally obvious is that any skill upgrading in Rwanda towards both intermediate and

[34] Vocational training skills and global knowledge skills are output measures for the availability of talent in the medium-skill and high-skill segments of the labour force, respectively. For details, see notes for Figure 15.

advanced skills would facilitate the adoption of new disruptive technologies related to Industry 4.0. Given this current skill profile, a quantitative as well as qualitative upgrading of the vocational training system could be an important steppingstone towards closing the apparent skill gap.[35]

Against this background, it is not surprising that Rwanda is categorized as a laggard economy in the Industrial Development Report (UNIDO, 2020), that is, an economy that is not strongly engaged in advanced digital technologies and Industry 4.0. An ambitious objective for Rwanda, in line with numerous other development objectives, could thus be to become a follower economy as a user of advanced digital technologies, a position currently maintained by South Africa, for example.[36] Follower economies are economies that participate in the global economy as users of advanced digital technologies, but are neither actively involved in Industry 4.0 innovation activities nor in the production of such technologies – an activity performed by frontrunner economies only. However, they can strongly benefit by absorbing and adapting such technologies to their specific needs.

Figure 16: Population shares by skill level, 2019 or latest year available

Skill level	Rwanda	Burundi	Kenya	Tanzania	Uganda
Unknown		0.0%	0.7%		71.1%
Less than basic	12.7%	82.6%	10.5%	77.4%	13.4%
Basic	69.7%	13.9%	45.3%	17.5%	7.0%
Intermediate	11.2%	2.6%	39.0%	4.1%	8.2%
Advanced	6.3%	0.9%	4.4%	1.0%	0.4%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Skill level	Mali	Malawi	Chad	South Africa	Ethiopia
Unknown			0.1%	1.6%	2.0%
Less than basic	69.9%	14.2%	64.8%	12.4%	50.7%
Basic	23.9%	72.9%	26.6%	48.1%	40.2%
Intermediate	4.2%	11.9%	5.7%	26.9%	6.1%
Advanced	2.0%	1.0%	2.7%	10.9%	1.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

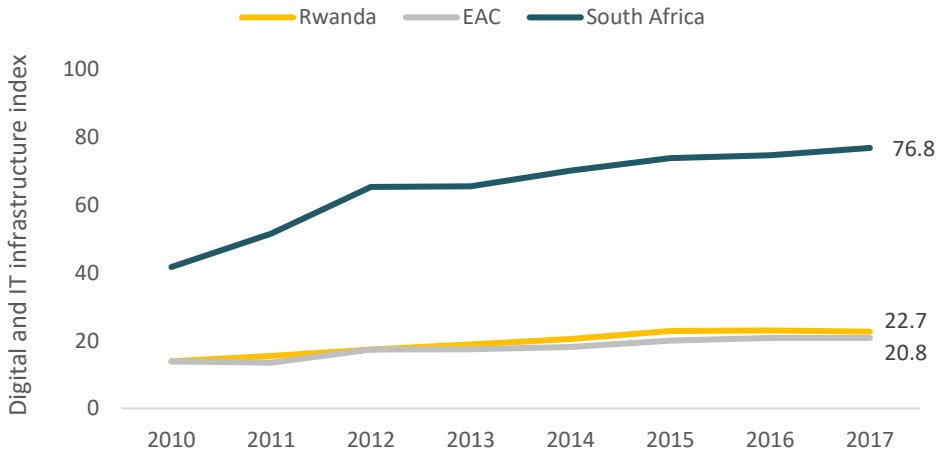
Note: Data refers to working-age population. Data refers to 2013 for Ethiopia; 2014 for Burundi, Tanzania; 2016 for Kenya; 2017 for Uganda and Malawi; 2018 for Mali and Chad.
Source: ILO database (based on national LFS data).

Continuous investments in digital and ICT infrastructure and complementary skills is one way to benefit from the new digital technologies which can help overcome existing bottlenecks and foster substantial productivity increases. In fact, these investments are crucial as no country will remain unaffected by the disruptive impact of digital technologies on industry and societies as a whole. Moreover, the technologies will affect what, how and where manufacturing products are produced, irrespective of their tech content (World Bank and Government of Rwanda, 2019). Industry 4.0 will generate an increasing merger of products and services. Specifically, the continuous embedment of software,

[35] See also Ministry of Trade and Industry (2011).
[36] Malawi, Uganda and Ethiopia are categorized as latecomer economies (as users), while all other comparator countries are classified as laggards.

sensors and network connectivity in products—ranging from smart watches to smart homes—can help countries address existing business obstacles. For example, modern technologies might mitigate the disadvantages related to Rwanda's distance to major markets. Rwanda is therefore likely to benefit from its investments in network connectivity and sensor deployment in different applications (World Bank and Government of Rwanda, 2019). Examples include investments in the use of (unmanned) drones for deliveries of critical medical supplies to remote locations; the use of an electronic platform in agriculture that provides farmers, consumers and traders with up-to-date price information by short message service; and in mobile phone networks. With regard to the latter, the Government of Rwanda, in partnership with the Korean telecommunications provider KT Corporation, is rolling out a high-speed 4G (LTE) broadband network across the country, which aims to achieve a coverage of 95 per cent.[37]

Figure 17: Digital & IT infrastructure in Rwanda and competitor countries, 2010–2017



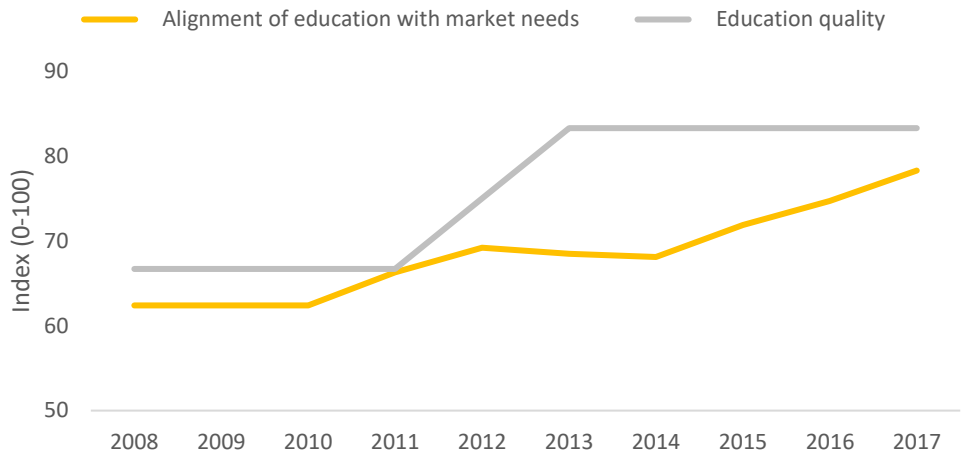
Note: The Digital & IT Infrastructure Index captures the extent to which IT infrastructure is adequate for business needs; subscriptions to a mobile telephone service; households with a computer; and internet subscriptions. It consists of four sub-indicators.
Source: Ibrahim Index of African Governance.

These services and technologies are just the beginning, and Rwanda's firms and consumers would certainly benefit from further investments in the digital and IT infrastructure, which still has substantial potential for further improvements, despite the progress that has been achieved over the past years (Figure 17).

Interestingly, there seems to be a positive perception in Rwanda about the domestic education system (Figure 18). Rwanda scores high in terms of adequacy of education provided with regard to market needs (78 out of 100) and the quality of the educational system (83 out of 100).

[37] See: https://infomineo.com/rwandas-knowledge-economy/.

Figure 18: Quality of education and its alignment with market needs, 2008–2017



Note: Alignment of education with market needs is an indicator that assesses how well the educational system meets the needs of a competitive economy, ranging from 'not well at all' to 'extremely well'. Education quality assesses the extent to which there are solid institutions for basic, secondary and tertiary education, as well as for research and development. It assesses whether education policy is successful in delivering high-quality education and training, and research and development receive effective support from the government. It does not focus on expenditures alone, but also on the quality and competitiveness of the education system and the research sector, considering: the structure of funding and knowledge providers (public, private and international cooperation); the output of the educational and developmental efforts, e.g. enrolment rates, literacy rates, percentage of people with higher education; and number of patent applications.
Source: Ibrahim Index of African Governance.

Combined with the scores for the country's skill base and its digital and ICT infrastructure, this positive assessment indicates that Rwanda's economy is generally not yet geared towards Industry 4.0. Nevertheless, many of the trends and above-mentioned examples indicate that with the appropriate investments in skills and infrastructure, the country could indeed benefit from the digital transformation as a user of advanced digital technologies.

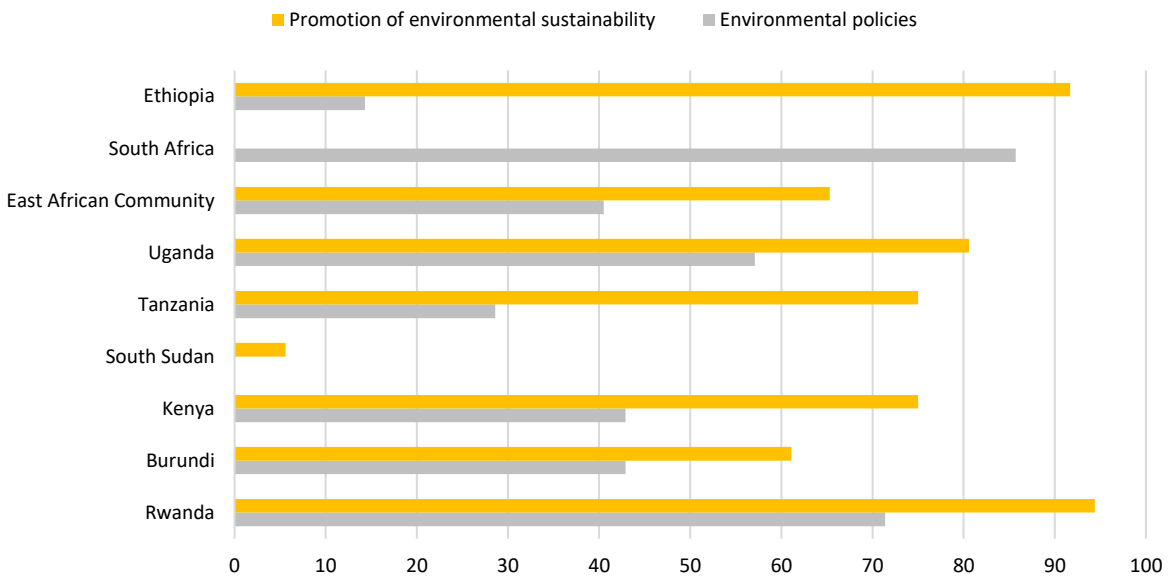
Science, technology and ICT was already considered a key cross-cutting issue for Rwanda in its Vision 2020, and a highly developed human capital base is identified as a future driver of growth, which is therefore likely to be an essential element of Vision 2050, given that the digital transformation can be assumed to remain one of the megatrends.

III. Environmental Performance

a) Clean and circular production

Rwanda has taken a strategic decision to pursue a green growth approach to development. This goal was first stated in the 2003 Environmental Policy and is the cornerstone of the most recent 'National Environment and Climate Change Policy'(Ministry of Environment of Rwanda, 2019). Indeed, the environmental policy indicator, which measures the extent to which environmental concerns are taken into account in government regulations, suggests that Rwanda is one of the most environment-oriented countries in Africa, second only to a much more developed South Africa. Also, in terms of promotion of the environmental sustainability indicator, Rwanda scores high among its peers (Figure 19).

Figure 19: Indicators of environmental policy and promotion of environmental sustainability in Rwanda and comparator countries, 2017



Note: The environmental policy indicator assesses the extent to which environmental concerns are effectively taken into account in both macro- and micro-economic terms. It considers the extent to which the externalization of costs or inadequate time horizons are avoided or restrained by environmental regulation. In macro-economic terms, it assesses whether tax and energy policies take ecological goals and measures into account (e.g. promotion of renewable energies, CO_2 reduction goals). In micro-economic terms, it assesses whether the government sets incentives for environmentally sound consumption and investments by households and companies. A deeply ingrained awareness of the environment or nature in society may serve as a functional equivalent. The indicator of promotion of environmental sustainability captures the extent to which environmental policies promote the protection and sustainable use of natural resources and the management of pollution. It consists of two sub-indicators.
Source: Ibrahim Index of African governance, http://iiag.online/

However, Rwanda is facing a wide range of environmental problems and challenges, including high population density, water, air and soil pollution, land degradation, fossil fuel dependency, high-carbon transport systems, irrational exploitation of natural ecosystems, lack of low-carbon materials for housing and green infrastructure development, inadequate waste treatment, and increased electronic,

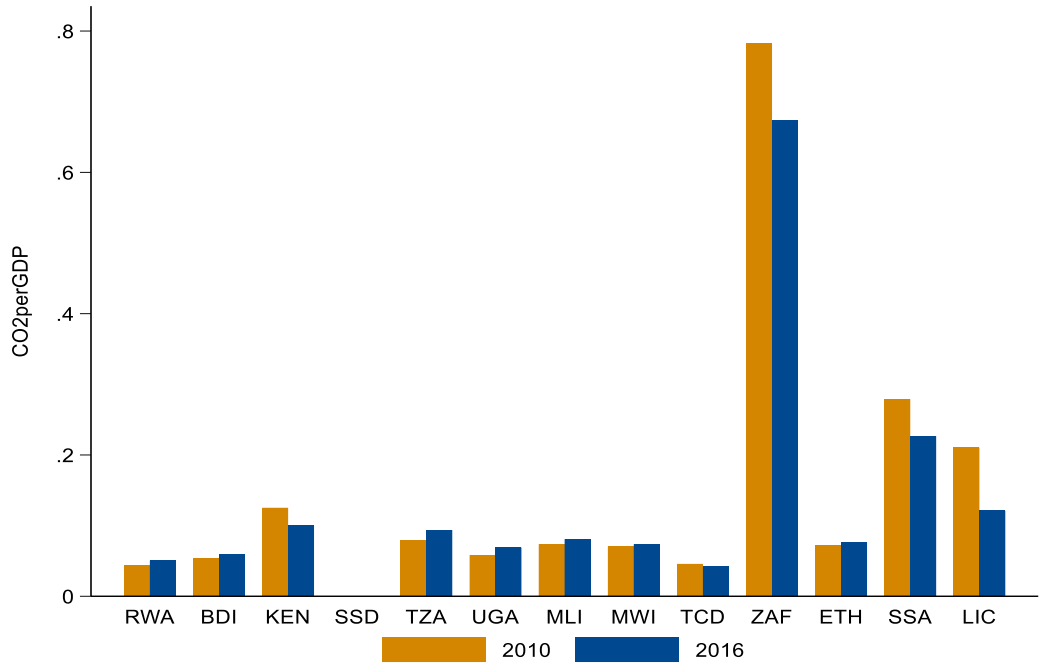
hazardous chemicals and materials waste, among others (Ministry of Environment of Rwanda, 2019). Many of these problems have been exacerbated by the high growth of population and of GDP over the past decades.

Climate change and carbon emissions

Rwanda has very low carbon dioxide (CO_2) per capita emissions, even in comparison with other African countries (Figure 20). At the same time, it has been disproportionately affected by climate change. The country's average temperature has risen by 1.4 degrees Celsius since 1970, which is more than the global average, and is projected to increase by another 1.1 degrees by 2050 in the absence of mitigation measures (Ministry of Environment of Rwanda, 2019).

One consequence of climate change has been the increased frequency and severity of natural disasters. Rainfall patterns have become much more erratic, creating problems for agricultural producers. Besides, severe torrential rains have been causing heavy floods, resulting in large-scale destruction (REMA, 2019). According to some estimates, for instance, Rwanda lost about 1.4 per cent of its GDP due to flooding in the 2011/2012 fiscal year (Ministry of Environment of Rwanda, 2019).

Figure 20: CO_2 emissions per GDP in Rwanda and competitor countries, 2010 and 2016 (kg per PPP$ of GDP)



Source: World Bank WDI database.

Deforestation

Over the past 50 years, Rwanda has lost over half of its natural forest estate. According to a government report from 2009, the bulk of deforestation (78.3 per cent) has been due to illegal logging, with other reasons—charcoal production, livestock grazing, farming, bushfires, stem debarking, mining and beekeeping—lagging far behind in significance. Firewood is by far the most important fuel used

by households for cooking, albeit with a declining trend over time (Table 5). In addition, the majority of industrial processing operations in Rwanda use fuel wood as a source of energy as well (REMA, 2009).

Table 5: Distribution of households by primary fuel used for cooking in Rwanda

Fuel	2013/14	2016/17
Firewood	83.3%	79.9%
Charcoal	15.2%	17.4%
Gas	0.1%	1.1%
Others	0.8%	0.9%

Source: REMA (2019).

Recently, the government has undertaken various initiatives to reverse the trend of deforestation, most notably through pilot projects such as green villages, afforestation programmes and rehabilitation and restoration of degraded areas. Rwanda has also managed to preserve a green canopy within national protected areas. On account of all these measures, forest coverage increased to 29.8 per cent (from 28.3 per cent in 2012) by 2017, of which 11.9 percentage points are accounted for by natural forests. This nearly matches the government target set for 2020 (30 per cent). Biodiversity conservation also resulted in the expansion of eco-tourism, which has become an increasingly important economic sector (Ministry of Environment of Rwanda, 2019).

To facilitate reforestation, the government has also set targets for the percentage of households using firewood for cooking. According to the National Strategy for Transformation, this percentage shall be reduced to 66 per cent by 2020/21 and to 42 per cent by 2023/24. Clearly, reaching these targets would require a replacement of firewood with other energy sources, such as gas and electricity, which are other important areas of policy intervention.

Land degradation

Deforestation has also been one of the factors facilitating soil erosion and the degradation of lands more generally. Rwandan soils are naturally fragile, and human activities, such as over-cultivation due to high population density and the use of chemical fertilizers, are adding to their degradation. Rwanda is among the three countries in Africa experiencing unusually heavy soil loss. About half of its farmland has shown evidence of modest to severe erosion, especially in the highlands. In 1986, the agricultural survey and statistics service estimated that 10 tonnes/ha of arable land was being carried away by erosion every year (Republic of Rwanda, 2004).

This has adverse effects on land productivity, has caused an increasing number of landslides, and has resulted in the conversion of farmland into wasteland. The deterioration of soil reduces food availability for people who depend solely on agriculture. In 2011, it was estimated that soil erosion affected the ability to feed about 40,000 people per year (REMA, 2019).

Waste management and circular economy

Waste management in Rwanda is still in its infancy. For instance, residential units are currently not serviced by centralized systems and utilities, neither in urban nor in rural areas. The waste

management system consists of the following elements: (i) solid waste collection, fully provided by private companies and paid directly by households, (ii) small wastewater treatment units specific to a building or a semi-collective sewer network, which releases uncontrolled treated effluent, (iii) septic tanks for individual houses and small buildings, and (iv) individual latrines which are emptied regularly with the faecal sludge disposed in dumping sites (REMA, 2019).

In general, the country has a lot of legislation and regulations on solid waste management, but their enforcement is weak. For instance, there is a prohibition of manufacturing, importation, use and sales of polythene bags in Rwanda (in place since 2008), but some people reportedly use plastic bags that entered Rwanda illegally (Kabera and Nishimwe, 2019). In addition, the poor disposal of electronic, industrial and nuclear/radioactive waste poses environmental and health risks (Ministry of Environment of Uganda, 2019).

Most studies on solid waste management in Rwanda focus on the capital City of Kigali, and some include useful comparisons with other major cities in East Africa (Table 6). Municipal solid waste (MSW) generation in Kigali is still low by regional comparison. However, it has doubled over the past eight years, from around 400 to approximately 800 tonnes per day, driven by fast economic growth and the rapid rise in the city's population (on average, by 2.6 per cent annually between 2002 and 2012, with the trend likely having continued in recent years). Based on the current trends, it is estimated that MSW generation in Kigali could increase by 63 per cent over the next ten years (Rajashekar et al., 2019).

Table 6: Solid waste management in Kigali, compared to other four major East African cities

	Maputo (Mozambique)	Kampala (Uganda)	Dar es Salaam (Tanzania)	Kigali (Rwanda)	Nairobi (Kenya)
MSW per capita (kg/year)	316	201	346	205	350
Waste collection coverage	82%	50%	40%	88%	52%
Controlled treatment/disposal	0%	55%	0%	0%	0%
Recycling rate	<5%	11%	18%	12%	30%

Note: MSW = Municipal solid waste.
Source: Kabera et al., 2019.

Kigali's waste collection system is based on a public-private partnership, with waste collection carried out by 12 private companies operating exclusive franchises. Kigali's only dumpsite (Nduba), which is owned by the city, was put in operation in 2012 with assistance from the United Nations Development Programme (UNDP). The system works reasonably well, and Kigali has a high waste collection coverage of 88 per cent[38] – roughly on par with Maputo, which has benefited from extensive international assistance in this field and is much higher than in other regional peers (Table 6). This arguably makes Kigali one of the cleanest cities in Africa (Kabera et al., 2019). The progress in MSW collection in Kigali

[38] According to some other studies, however, the waste collection coverage rate in Kigali may be much lower. Rajashekar et al. (2019), for instance, put it at only 49 per cent.

has been relatively recent: in 2012, the coverage rate was still a mere 44 per cent (other urban areas of Uganda have witnessed rising waste collection rates as well, although on a less impressive scale: from 20 per cent to 35 per cent between 2012 and 2015) (REMA, 2019).

At the same time, similarly to most regional peers (except Kampala, which has an engineered disposal site), Kigali scores poorly with respect to waste treatment and disposal. The Nduba dumpsite is an open-air site, which lacks monitoring and verification of environmental controls. Its environmental problems include, inter alia, leachate with high polluting potential, vermin and flies, unpleasant smells and spontaneous combustions. An environmental impact assessment (EIA) of the site has never been conducted, since it was originally supposed to only be in operation for two years until a sanitary landfill, a composting site and a waste-to-energy site were built. However, these projects have never been implemented (Rajashekar et al, 2019).

Promoting circular economy is one of the government's priorities within the 'greening economic transformation' policy objective (Ministry of Environment, 2019). However, the recycling rate of MSW in Kigali (data for Rwanda as a whole are not available) is rather low. Officially, it stands at 2 per cent (Office of the Auditor General of State Finances, Rwanda, 2016), although alternative studies have found slightly higher figures: between 10 per cent and 12 per cent (Kabera and Nishimwe, 2019; Kabera et al., 2019). For comparison, both Dar es Salaam and especially Nairobi have much higher recycling rates. Kigali has no official recycling system, and recycling activities are generally performed informally by private companies (mostly focusing on paper and plastics). There is no domestic recycling facility for PET bottles, which are taken to neighbouring Uganda, Kenya, Tanzania and, until recently, China, to be recycled (Rajashekar et al, 2019).

The prime reason for Rwanda's low recycling rate is the fact that people do not separate waste at the source. Kigali was the first city in East Africa to introduce a system of waste separation in 2008, which worked well for a while. However, irregular collection of sorted waste and the above-mentioned failure to build a recycling facility at Nduba have shaken trust in the system. Currently, all recycling in Kigali is done from mixed wastes, either by collection workers employed by private companies or by pickers working at Nduba or at illegal dumpsites (Kabera et al., 2019).

Over the last decade, Rwanda has recognized that poor solid waste management is a key obstacle to sustainable development. This is reflected in the solid waste management targets both at the national and city levels, which are to promote a 'green economy'. Specifically, Rwanda's Vision 2020 strategy highlights the need for all towns to be serviced by solid waste treatment plants. As highlighted in the National Sanitation Policy Implementation Strategy of 2016, the government aims to properly dispose of 60 per cent of domestic waste by 2019/2020 and 80 per cent by 2029/2030. The target for the recycling rate of non-organic solid waste for 2019/2020 is set at 30 per cent and 40 per cent for 2029/2030 (Rajashekar et al., 2019). Meeting these targets requires considerable policy efforts, both in Kigali and elsewhere in the country. The construction of sanitary landfills and waste treatment plants would reduce the incidence of uncontrolled dumping, raise the recycling rate, and encourage waste separation at the source, thus contributing to the goal of a circular economy.

Water resource management

Rwanda has abundant water resources, being part of both the Congo and the Nile River basins and with several large lakes on its borders with DR Congo and Burundi. In total, wetlands represent about 14.9 per cent of the country's area, of which 6.3 per cent are marshlands and 8.6 per cent are lakes and rivers (REMA, 2019). Rivers belonging to the Nile basin are especially voluminous, and some of them offer hydropower potential, which is not yet being fully exploited (see also section b) below).

Only 20 per cent of total wetlands are fully protected, with 74 per cent under conditional and another 6 per cent under unconditional exploitation (REMA, 2019). Over the past decades, the acute scarcity of land has accelerated the conversion of wetlands into agricultural production. Climate change has played a role as well, as decreasing amounts of rainfall have threatened the hydrological regime of wetlands. In such instances, there tends to be a reduction in the water recharge capacity, since wetlands remove sediments, nutrients, toxic substances and other pollutants, and thus improve water quality. Moreover, overall water availability is reduced as well, while sediments interfere with the smooth flow of water; both negatively affect hydropower potential. Reduced water flow from degraded wetlands to hydropower stations has resulted in energy crises in the past (REMA, 2009).

Rwanda's water resources are generally still of a relatively good quality, with pH values between 6 and 7.5 (Ministry of Environment of Rwanda, 2019). However, increasing pollution from agro-inputs has affected local groundwater, and the ability of ecosystems to naturally purify water is a concern. In addition, land degradation results in water siltation and reduced water quality (REMA, 2019). In urban areas, non-treated effluents are often dumped in rivers and marshlands, which results in a high concentration of coliform bacteria (REMA, 2009).

Also, most of the industries lack waste treatment. Mining, in particular, is a major source of water pollution. There are localized problems from high sediment loads and toxic and acidifying materials, including heavy metals (Ministry of Environment of Rwanda, 2019). The preparation of ores, which uses a lot of water, constitutes a major polluter of streams. A specific case in point is the water draining in the mining sectors of Rutongo and Gatumba, which pollute the rivers of Nyabarongo and Nyabugogo by sediments of clay and sand, which they transport over long distances. It is this considerable mineral load that partly gives them the brown colour that is characteristic of the rivers in Rwanda (REMA, 2009).

For these reasons, the quality of water is not always satisfactory. Water quality tests have revealed that some rivers contained high levels of the elements under investigation, exceeding WHO recommendations for drinking water (REMA, 2009). However, access to drinkable water has increased in recent years to 87 per cent in 2016/17, and the share in Kigali City is as high as 96 per cent (REMA, 2019).

In the future, water use in Rwanda is expected to increase, with more demand for irrigation, more hydropower generation, and higher water use for industrial purposes, especially the water-intensive, washed coffee processing (REMA, 2009). To this end, the government developed the National Policy for Water Resources Management in 2011 as a framework for the conservation, protection and management of water resources in Rwanda.

b) Energy

Access to electricity. High relative energy costs and unreliable power supply is a disincentive for industrial growth and business expansion (Ministry of Infrastructure, 2015). For a long time, limited access to electricity and frequent blackouts have been one of the key obstacles for industrial sector growth (Hausmann and Chauvin, 2015), especially in rural areas. As a result of significant investments, basic infrastructure, including energy supply, has improved consistently over the past decade (World Bank and Government of Rwanda, 2019, p. 4). Nevertheless, energy, and above all electricity, remains a crucial and sensitive issue and is one of Rwanda's bottlenecks for economic development in general, and the emergence of a competitive manufacturing sector, in particular. Consultations with stakeholders confirmed that access to electricity as such has eased slightly in recent years, which is confirmed by the data (Figure 21, panel a). Between 2010 and 2018, the share of the population with access to electricity more than tripled, from 10 per cent to 35 per cent. Rwanda's development follows the region's general trend, with many other East African countries making remarkable strides in terms of electricity access. For a further discussion on energy as a bottleneck for business development, see Chapter 3.

Electricity remains a crucial issue in Rwanda's economic development and its social inclusion ambitions for (at least) two reasons. First, there is a significant divide between electrification in rural and in urban areas (Figure 21, panel b). As of 2018, only about 23 per cent of the rural population had access to electricity, compared to nearly 90 per cent in urban centres. Second, the issue of the cost of electricity remains.

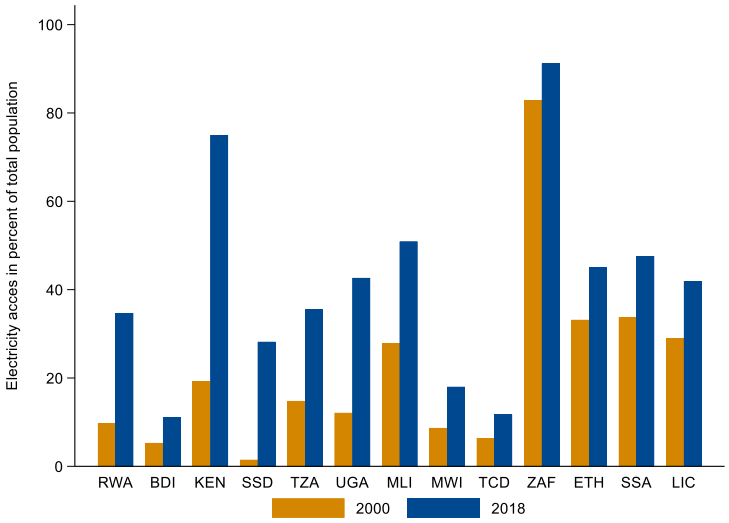
Price of electricity. Interestingly, the comparison of electricity prices in Rwanda with those in comparator countries does not point towards excessively high tariffs according to the World Bank's Ease of Doing Business indicators (Figure 22) in 2018. Moreover, the overall price of electricity in Rwanda has declined considerably to about USD 0.13,7 per kWh in 2020. This suggests Rwandan electricity prices are well below those in Kenya and Uganda and only slightly above those in Tanzania. A recent publication, however, concludes that electricity tariffs are about 22 per cent higher than in other EAC countries (Bimenyimana et al., 2018). In a similar vein, Rwanda's Ministry of Infrastructure (2015)[39] states that the electricity tariff in Rwanda is relatively high compared to other countries in the region and heavily subsidized. Likewise, in a joint report, the World Bank and the Government of Rwanda (2019) lists the high cost of energy generation as one of the key reasons for the elevated production costs. According to this report, the high cost of energy generation in Rwanda is, along with the small market size, the far distance to external markets (by virtue of being landlocked), shallow and costly credit markets and scarcity of land, a major reason for the generally high production costs. One possible explanation for these seemingly contradictory assessments is that electricity prices developed differently across sectors, with prices in the industrial sector actually increasing. The issue of industrial electricity prices is certainly key for international competitiveness, which is why this issue is further

[39] The document refers to a report by Energy & Economics Consulting from 2014 (*'Review of Current Electricity End User Tariffs: Final Report to RURA'*).

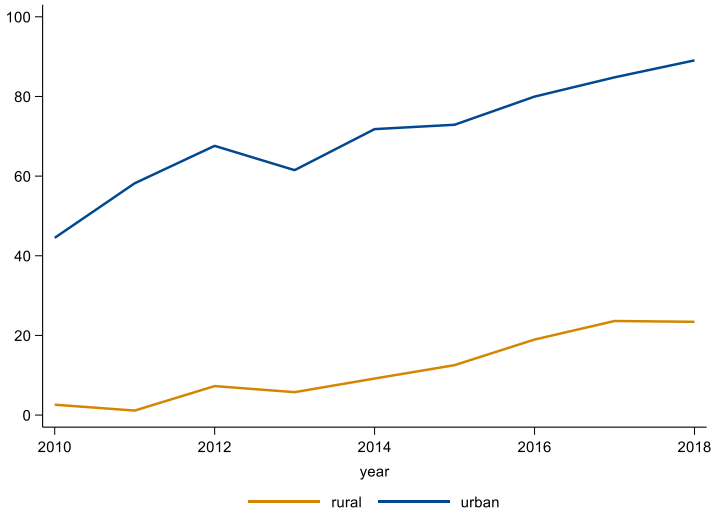
discussed in Section 3 in the context of the country's main bottlenecks experienced by Rwanda manufacturing firms.

Figure 21: Access to electricity in Rwanda and comparator countries, 2010–2018

(a) Rwanda and comparator countries, total population, 2010 vs 2018



(b) Electricity access in Rwanda, rural versus urban population, 2010–2018

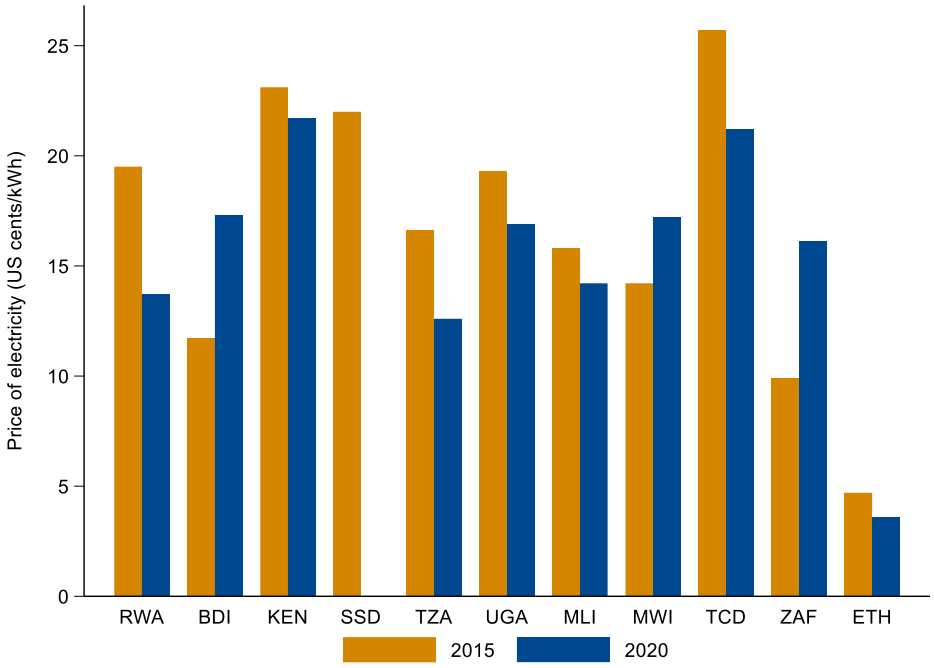


Source: World Bank WDI.

Hence, the Rwandan government seems well aware of the crucial role of electricity prices as an input cost for the domestic economy and the manufacturing sector, in particular. This is why industrial

customers are offered preferential rates, ranging from Rwanda francs (RWF) 134 (USD 0.138) per kWh for small-scale industries to RWF 106 (USD 0.109) per kWh.[40]

Figure 22: Price of electricity in Rwanda and comparator countries, 2015 vs 2020



Note: Price of electricity is in US cents per kilowatt hour (kWh). South Sudan: data for 2020 are not available.
Source: World Bank's Ease of Doing Business Database.

Energy efficiency and the energy mix. Another crucial issue is energy efficiency. A relevant measure for energy efficiency is energy intensity, defined as the primary energy requirement per unit of output. Energy intensity clearly declined between 2010 and 2019 in Rwanda, which means that energy efficiency improved over time. Nevertheless, energy efficiency still appears to be low in comparison with comparator countries (Figure 23). This indicator must be interpreted in the context of the countries' general level of development, in particular, the high degree of subsistence agriculture in Rwanda and the comparatively low rate of electrification. According to the Rwanda Development Board, biomass (essentially, the use of wood) accounts for 80 per cent of its overall primary energy consumption.[41] The country aims to reduce this rate to 42 per cent by 2024, which can only be achieved if the country gets electrified, which is one of the country's key priorities.

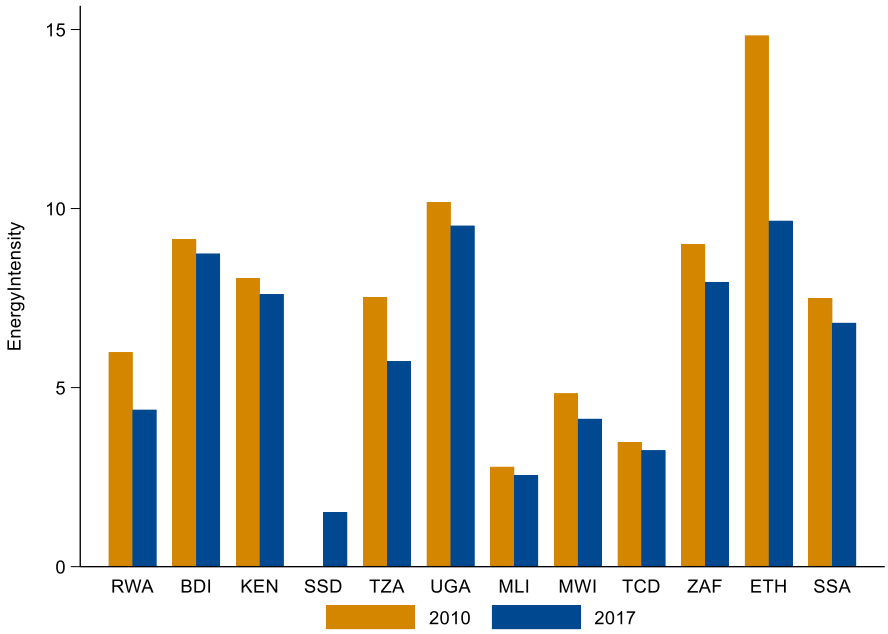
A country's energy efficiency is obviously strongly dependent on the energy mix. In this respect, Rwanda stands out as a country with a comfortably high share of renewable energy in the energy mix,

[40] Electricity tariffs as of January 2020 according to Rwanda Energy Group. See: https://www.reg.rw/customer-service/tariffs/. Note that these figures correspond with the data reported by the World Bank.

[41] See Rwanda Development Board (RDB): https://rdb.rw/investment-opportunities/energy/#tab-1-2. Energypedia puts the share of biomass in primary energy consumption at 85 per cent without indication of the year it is referring to. See: https://energypedia.info/wiki/Rwanda_Energy_Situation#cite_note-Energy_resource-0. In any case, this confirms the extremely high share of biomass in the country's energy mix.

with energy consumption (Figure 24) standing at 87 per cent in 2017. This is in line with prevailing renewable energy consumption shares in EAC partner countries, which are similarly high. This is explained by two factors. First, Rwanda (as well as the EAC partners), strongly relies on biomass (in particular, wood for cooking and heating), especially in rural areas where the overwhelming majority of households do not yet have access to electricity.

Figure 23: Energy intensity in Rwanda and comparator countries, 2010 vs 2017



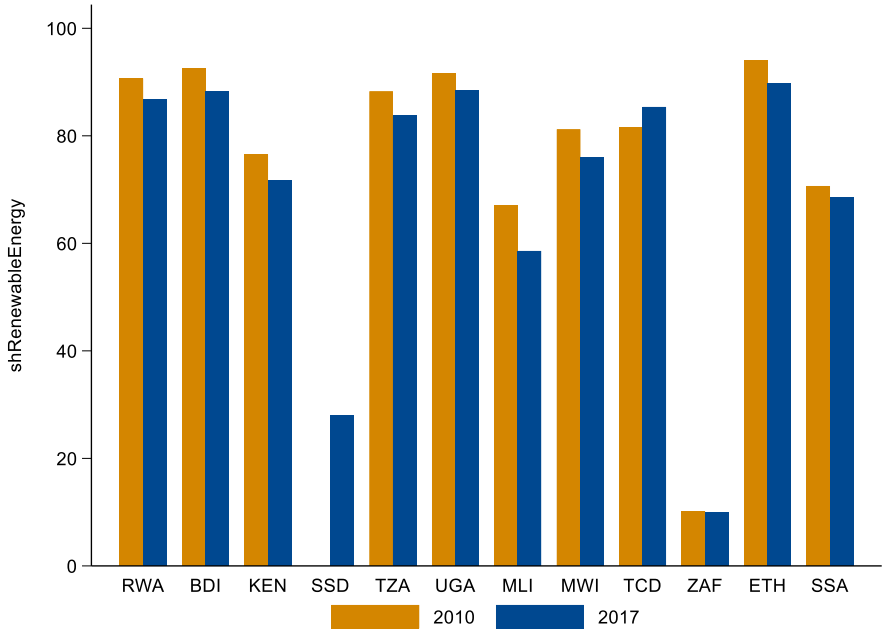
Note: Energy intensity is measured as the energy intensity level of primary energy (megajoules per constant 2011 purchasing power parity GDP). It corresponds to indicator 7.3.1 with goal number 7 of the Sustainable Development Goals (SDG). Energy intensity is an inversely related measure for a country's energy efficiency.
Source: UN Sustainable Development Goals (SDG) database based on data from the Energy Balances, UN Statistics Division (2019) and the IEA (2019), World Energy.

Second, hydropower is Rwanda's primary source for electricity production accounting for around half of total electricity generation (Bimenyimana et al., 2018). Given the fact that other forms of renewable energy generation, such as solar power, are still underdeveloped, the overall share of renewable energy in electricity production is also about 50 per cent (Eustache et al., 2019). In any case, it is important to keep the country's relatively low electrification rate in mind, which results in a very high share of renewable energy sources in overall energy generation due to reliance on biomass, whereas the share of renewables in electricity generation, while still high, is much lower.

To summarize, the Government of Rwanda acknowledges the key role access to electricity plays for accelerating living standards and economic development as well as for the internal cohesion of the country, and has therefore set ambitious targets. The Energy Policy of 2015 (Ministry of Infrastructure, 2015) initially aimed to achieve an electrification rate of 100 per cent by 2020, a date that in the meantime has been postponed to the year 2023/24, of which 52 per cent on-grid connections and 48

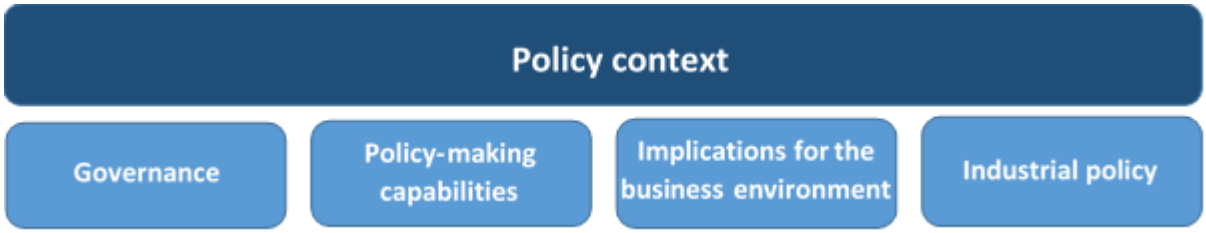
per cent off-grid connections (Bimenyimana et al., 2018). To achieve these targets, additional efforts are, however, needed (Government of Rwanda, 2018).

Figure 24: Share of renewable energy sources in total energy consumption in Rwanda and comparator countries, 2010 vs 2018



Note: Renewables include hydropower.
Source: UN Sustainable Development Goals (SDG) database based on data from the Energy Balances, UN Statistics Division (2019) and the IEA (2019), World Energy.

IV. Policy Context



a) Governance in Rwanda

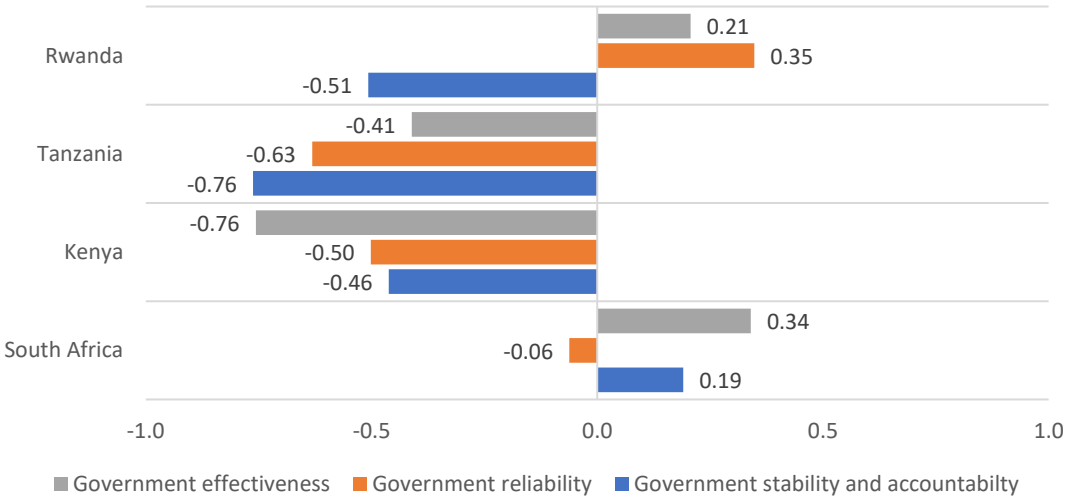
Overall governance

The capacity and efficacy of public institutions are a central element of any development process, as a dysfunctional state inhibits any entrepreneurial activity within the private sector. That is why the NST includes transformational governance as one of its three pillars (Government of Rwanda, 2017). A glance at internationally comparable indicators for overall governance performance from the World Bank reveals that Rwanda outperforms key partners in the EAC, notably Tanzania and Kenya, in

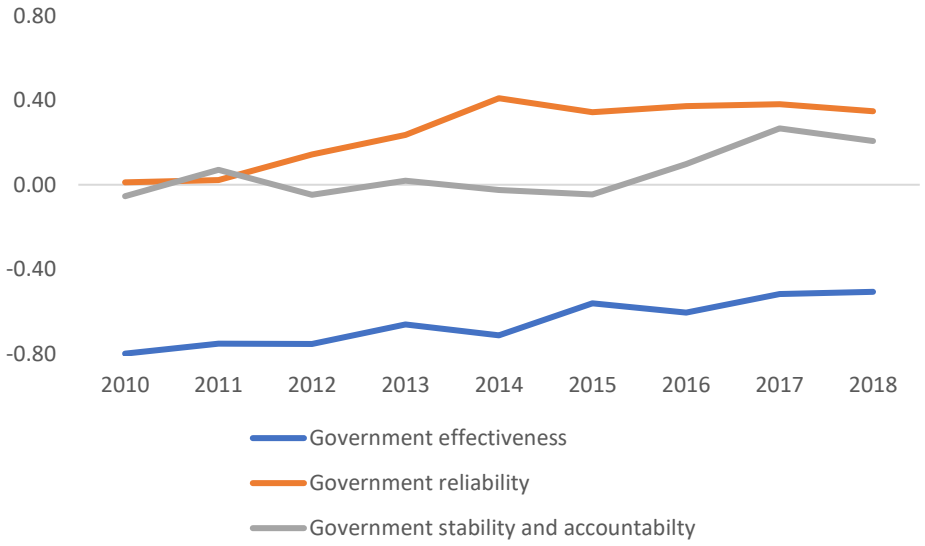
important dimensions, such as government reliability and government effectiveness (Figure 25, panel a). In terms of government stability and accountability, Rwanda's scores are lower, which is mainly due to the comparatively low level of government accountability. Hence, accountability is one dimension where there is room for improvement, which is in line with the government's own objectives including, inter alia, the establishment of a legal framework that ensures fairness, transparency and accountability across institutions and individuals (Government of Rwanda, 2017).

Figure 25: Governance performance of Rwanda

(a) Comparison with selected comparator countries, 2018



(b) Development over time, 2010–2018



Note: Government stability and accountability is the average of the indicators *Political Stability and Absence of Violence/Terrorism* and *Voice and Accountability;* government reliability is the average of the indicators "*Rule of Law"* and *"Control of Corruption"*; government effectiveness as defined by the World Bank. Values range from -2.5 (weak) to +2.5 (strong). All values in the database are estimates.
Source: World Bank's Worldwide Governance Indicators (WGI) database.

Overall, governance performance has markedly improved in recent years (Figure 25, panel b), a fact that can be assumed to have fed positively into the country's dynamic growth – directly via facilitating business activities and indirectly by inspiring optimism and confidence among citizens and investors alike.

b) Policymaking: formulation, implementation and evaluation

The quality and capacities of institutions are decisive for overall policymaking. In this respect, it is useful to divide the policymaking process into the (i) formulation stage (policy design), (ii) the implementation stage, (iii) monitoring and evaluation stage, and (iv) learning from previous policy experiences. Developing countries have generally achieved substantial progress in the formulation of industrial policies (and policies in general). Mixed results prevail for the implementation of policies, whereas serious and independent evaluation is often absent.

Table 7: Rwanda's policymaking capacity, 2019/2020

	Policy design		**Implementation of policies**	**Statistical capacity (monitoring)**	**Policy learning**
	Coordination (score: 1-10)	Adaptability & future orientation (score: 1-7)	(score: 1-10)	(score: 1-100)	(score: 1-10)
Rwanda	7.0	5.6	5.0	65.6	5.0
Comparators					
Burundi	4.0	3.8	4.0	67.8	4.0
Kenya	4.0	4.4	5.0	57.8	5.0
South Sudan	2.0		2.0	45.6	1.0
Tanzania	4.0	4.3	6.0	62.2	4.0
Uganda	7.0	4.1	5.0	67.8	5.0
Mali	5.0	3.2	5.0	67.8	6.0
Malawi	5.0	3.1	6.0	73.3	6.0
Chad	2.0	2.8	3.0	50.0	1.0
South Africa	7.0	3.3	6.0	75.6	6.0
Ethiopia	4.0	3.8	5.0	61.1	5.0

Note: Policy design - coordination and policy, implementation of policies, policy learning: values refer to 2020. Policy design adaptability & future orientation; statistical capacity: values refer to 2019. Higher values/scores indicate better performance.
Source: Bertelsmann Transformation Index (BTI), World Economic Forum (WEF) Global Competitiveness Index Database (Version 2019), World Bank Statistical Capacity Indicators.

Table 7 presents Rwanda's policymaking capacity along these three dimensions. The comparison with the usual set of comparator countries suggests that Rwanda scores high in terms of designing appropriate policies (i.e. the formulation stage), where it is on par with Uganda and South Africa in terms of coordination, and ahead of all comparators in terms of adaptability. When it comes to implementing these policies, Rwanda appears to be midfield with the same scores as its EAC partners, Kenya and Tanzania. Policy evaluation, which is the most difficult component to assess, can to some extent be proxied by countries' statistical capacity because adequate statistical data is a prerequisite

for a proper monitoring and evaluation.[42] Rwanda's statistical capacity is comparable with that of most EAC partner countries, such as Uganda and Tanzania, but considerably lower than that of South Africa.

The next section explores the business community's sentiment regarding the business environment, which can be expected to be influenced by overall governance performance and the effectiveness of the actual policies.

c) Governance and implications for the business environment

The argument from above that better institutions have helped lower some of the most severe business obstacles for the private sector is confirmed by ease of doing business indicators[43] (Table 8). Together with Kenya, Rwanda registered the highest improvements in the overall Ease of Doing Business index between 2010 and 2020 among the list of comparator countries. This development means that Rwanda's business environment is the most favourable not only within the EAC, but also in comparison with Africa's leading industrial country, South Africa, and fast-growing Ethiopia.

Table 8: Ease of Doing Business in Rwanda and comparator countries, 2010–2020

	2010	2015	2016	2017	2018	2019	2020	Change in score 2010-2020	Change in score 2015-2020
Rwanda	60.8	67.5	67.1	69.0	71.1	75.4	76.5	15.7	8.9
Comparators									
Burundi	37.2	49.0	45.6	45.7	45.9	46.5	46.8	9.5	-2.2
Kenya	56.3	53.9	58.0	62.8	65.4	71.0	73.2	16.9	19.3
South Sudan		34.8	32.8	32.7	31.6	33.6	34.6		-0.1
Tanzania	51.8	54.5	49.7	53.9	54.0	54.3	54.5	2.7	0.0
Uganda	47.5	51.9	56.6	57.3	57.9	58.4	60.0	12.5	8.1
Mali	44.4	51.2	50.3	52.6	52.9	53.1	52.9	8.5	1.8
Malawi	48.9	47.6	49.7	53.2	59.5	60.4	60.9	12.0	13.4
Chad	30.4	33.1	35.3	36.0	35.5	36.7	36.9	6.5	3.8
South Africa	68.0	68.7	66.2	65.4	65.3	66.7	67.0	-1.0	-1.7
Ethiopia	45.7	46.1	43.8	44.1	46.1	47.1	48.0	2.3	1.9

Note: Values are overall index scores. 0 = lowest performance, 100 = best performance.
Source: World Bank's Ease of Doing Business Database.

Taking a closer look at the elements that feed into a favourable business environment, as measured by the Ease of Doing Business indicators, suggests that the protection of minority investors and trading across borders are the greatest obstacle for business (according to Rwanda's global rank). The issue of investor protection echoes the result on government accountability, whereas the issue of trading across borders is explained by a combination of the country's geographic location, but above all, the

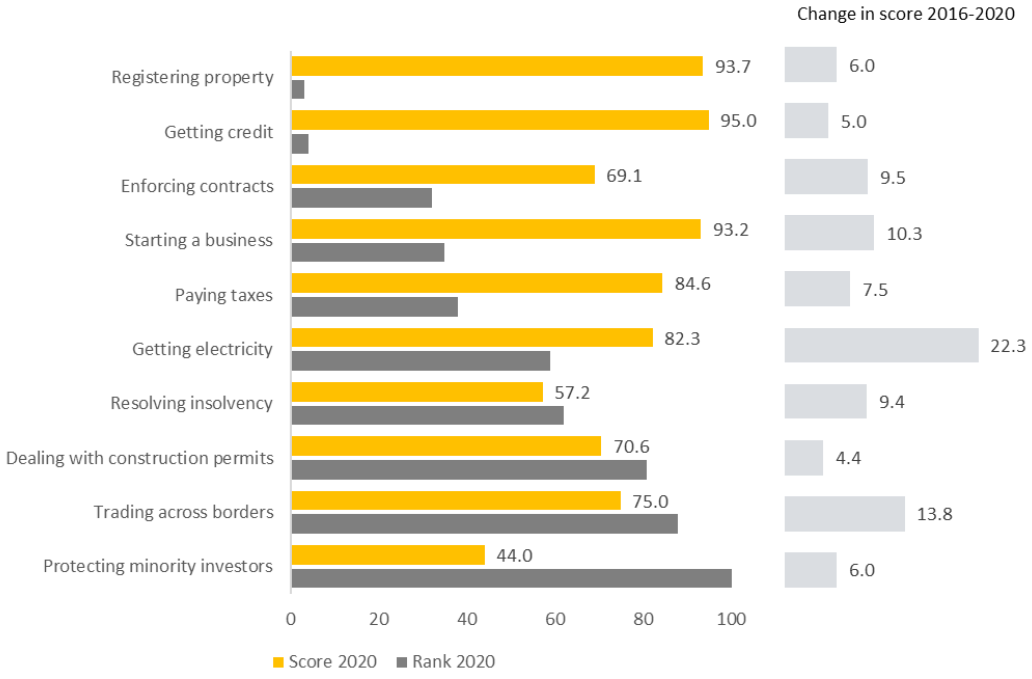
[42] Statistical data is a necessary but not a sufficient condition for independent monitoring and evaluation.

[43] As pointed out by the World Bank the Ease of Doing Business may be subject to data inconsistencies (see https://www.worldbank.org/en/news/statement/2020/08/27/doing-business).

remaining non-tariff barriers that continue to hamper trade with neighbouring countries, especially the Democratic Republic of Congo and Burundi.[44]

More generally, however, Rwanda scores remarkably high in registering property, enforcing contracts—again reflecting the comparatively good results for government reliability—starting a business and paying taxes. Importantly, the trend has been positive across all dimensions over the past ten years, with the biggest improvements achieved in access to electricity and trading across borders. The issue of access to finance (getting credit) is further elaborated in Chapter 3 of this report.

Figure 26: Ease of Doing Business in Rwanda, rankings and scores, 2020



Note: The rank refers to the ranking of a list of 190 countries.
Source: World Bank's Ease of Doing Business Database.

d) Industrial policy and structural transformation in Rwanda

Rwanda's industrial policy strategy dates back to 2011 (Ministry of Trade and Industry, 2011) and is currently in the process of being updated. Hence, priority areas and industries may change, but the broader position on industrial policy is unlikely to change which can be described as (i) being a comparative advantage-following strategy; (ii) combining export-orientation with import substitution; (iii) blending vertical and horizontal instruments; (iv) following an integrated value chain approach; (v) being supportive of regional integration; and (vi) being committed to environmental sustainability.

- ***A comparative advantage-following strategy.*** Rwanda's Industrial policy serves as a tool for growth and structural change. The role of industrial policy is to foster growth, value addition and dynamic

[44] See also Section 1.

expansion into new and nascent areas with latent potential (Ministry of Trade and Industry, 2011). For these reasons, industrial policy is geared towards developing the necessary skills, ensuring adequate infrastructure as well as absorbing the necessary technologies for newly targeted industries.

- ***Combining export-orientation with import substitution.*** Industrial policy is a hybrid form that combines export promotion policies (to *improve Rwanda's export competitiveness*) with import substitution policies (to *increase domestic production for local consumption*) without, however, resorting to protectionist policies. Rather, industrial policy is bound to be implemented in an environment of open markets. This approach requires firms to be internationally competitive, which in turn necessitates a supportive business environment (*enabling environment*). This two-pronged approach, supported by an enabling environment, is enshrined in the National Industrial Policy and confirmed in the Domestic Market Restructuring Strategy (Ministry of Trade and Industry, 2015a). The National Export Strategy II (Ministry of Trade and Industry, 2015b) further sets out the details of the industrial policy's export promotion leg while the Made in Rwanda strategy (2017) operationalizes the attempts to increase domestic value added by developing domestic value chains, thereby supporting the import substitution objectives.
- ***Employing all instruments of the industrial policy toolkit.*** Rwanda's industrial policy constitutes a blend of vertical and horizontal measures and support programmes. This approach is also manifested in the National Export Strategy, which relies on vertical and horizontal interventions, whereas the Made in Rwanda policy relies primarily on vertical measures to remove supply-side obstacles in specific value chains.
- ***Integrated value chain approach.*** Industrial policy measures are increasingly designed to support integrated value chains rather than individual industries, which itself combines vertical elements—the choice of priority value chains—with horizontal elements such as the proper functioning of value chains. They depends on the capabilities of the respective value chain as well as its linkages to upstream and downstream activities and a broad range of support activities beyond the boundary of the firm (e.g. access to raw materials, affordable and reliable infrastructure or access to international markets). Commitment to an integrated value chain approach is confirmed in the country's National Strategy for Transformation (NST) (Government of Rwanda, 2017) and support is provided, for example, by the National Industrial Research and Development Agency (NIRDA) of Rwanda, follows a targeted value chain approach "*that focuses on the full range of activities that are required to bring a product or service from conception, through the different phases of production, delivery to final consumers and final disposal after use"*.[45]

  The National Industrial Policy of 2011 identified ten value chains or clusters of priorities, differentiating between the short-, medium- and long term (Table 9, panel a) and have largely been confirmed in the NST in 2017 (Table 9, panel b). These priorities, however, are bound to change with the forthcoming revision of the industrial policy.

[45] See: https://www.nirda.gov.rw/nirda-innovate-for-industry.

Many of these industries and value chains are identified as promising industries in Chapter 2, notably agro-processing (food and beverages) and textiles (as well as wearing apparel).

Table 9: Priority industries according to Rwanda's policy documents

(a) National Industrial Policy of 2011

Short-term priorities	Medium-term priorities	Long-term priorities
Agro-processing	Construction materials	Building materials
Information and communication technologies (ICT)	Pharmaceuticals	Bio-plastics
High-end tourism	Chemical products	Other high-tech industries
Textiles		
Mineral processing		

(b) National Strategy for Transformation of 2017

Priority value chains	
Agro-processing Building materials	Horticulture
Construction materials	Tourism
Light manufacturing	Knowledge-based services
Meat and dairy	Logistics and transportation
Leather, textiles and garments	

Note: The list of priorities may change with the update of the industrial policy strategy. No distinction between the short-, medium- and long term is made in the NST.
Source: Ministry of Trade and Industry (2011).

- ***Intensifying regional integration.*** Rwanda's industrial policy is geared towards open markets and the advancement of regional integration, in particular. Therefore, the elimination of remaining obstacles to trade within the EAC, such as NTMs, is an integral part of the country's trade and industrial policy. The same is true for the further development of the Common Market for Eastern and Southern Africa (COMESA) and, in the longer term, the creation of a comprehensive African Continental Free Trade Area.
- ***Commitment to sustainable industrialization.*** In line with the objective of Vision 2020, soon to be replaced by Vision 2050, Rwanda aims to become a climate-resilient, low-carbon economy by 2050, by when it wants to have achieved high-income status. This necessitates a climate-resilient and low-carbon development path (Republic of Rwanda, 2011), which allows the country to decouple its economic development from emission growth. Likewise, the NST (Government of Rwanda, 2017), which is organized along three pillars (economic transformation, social transformation and

transformational governance) calls for the sustainable management of the environment and natural resources to transform Rwanda into a 'green economy'. Rwanda's industrial development process is therefore set to be propelled by green technologies and predominantly renewable energy sources, which is fully in line with the objective of becoming a globally competitive knowledge-based economy as envisaged by the NST (Government of Rwanda, 2017).

V. Summary of Section 1 and implications for PCP project design

Rwanda's two decade-long impressive growth spurt, its even more ambitious policy objective and the generally optimistic view of future development offer many economic opportunities, especially in the private sector.[46] These opportunities are to be pursued in the context of a global economy that is experiencing (i) two major transformations, an ecological and a digital transformation, both of which are potentially disruptive, and (ii) a major economic shock related to the COVID-pandemic. The two major transformations and the COVID shock necessitate concrete interventions in cross-cutting areas that are of strategic importance to Rwanda's economy, which shall help translate emerging opportunities from green and digital technologies into business opportunities with high domestic value added and high job creation potential, and to avoid the derailment of the very dynamic, longer-term growth trajectory Rwanda has embarked on.

While there are countless potential interventions that could support the national policy objectives, such as the graduation to a middle-income country by 2035, the macro-analysis of Rwanda's economy in combination with existing industrial development aspirations points towards five thematic components, which are of strategic relevance and cross-cutting by nature. These thematic components are listed in Table 10.

Table 10: Thematic components identified by the diagnostic report

Component	*Activity*
Component 1:	*Integrated value chain development*
Component 2:	*Governance development*
Component 3:	*Development of sustainable energy*
Component 4:	*Value added creation in a circular economy*
Component 5:	*Adequate skills for Industry 4.0 and investment promotion for economic diversification*

Source: Authors' own analyses.

[46] Rwanda's Private Sector Development Strategy (PSDS).

a) Thematic component 1: Integrated value chain development

Rwanda's export structure is highly geared towards minerals and agricultural products as revealed by Rwanda's top five export items, which together accounted for more than 90 per cent of total exports (see Table 1). A closer look at the processing stages of major export items, such as coffee, but also food and beverages, more generally revealed that the country is exporting the bulk of these products in unprocessed form. Close to 100 per cent of Rwandan coffee is exported unroasted while the share of unprocessed foods and beverages exceeded two-thirds in 2018 (see Table 3). This situation calls for a development of integrated agricultural value chains, stretching from agricultural production to modern processing technologies and further to marketing and sales, including for export markets. As illustrated (see Figure 5), the potential for productivity gains of such a structural upgrading would be substantial, as nearly 4 million Rwandans work in agriculture compared to 121,000 in overall manufacturing, with the latter's productivity level being more than three times higher than that of the former (see Figure 5). The development of a competitive food and beverages industry is thus capable of significantly contributing to the country's development objectives, including numerous quantitative targets of the NST, such as the creation of 214,000 decent and productive jobs annually, and a structural shift in the export base to high-value goods and services with the aim of growing exports by 17 per cent annually (Government of Rwanda, 2017). The development of viable and internationally competitive value chains in the food and beverages industries must take the backward linkages to the agricultural sector as well as the forward linkages to potential distributors or final consumers into account. Moreover, all functional aspects of the value chains and their interfaces should be well managed, many of which will go beyond the boundary of the food company itself, such as parts of the logistics, transportation or even packaging. Potential entry points for interventions therefore include:

- development of agro-processing parks with adequate infrastructure that meets the requirements of the respective value chain, e.g. fruits and vegetables. The advantage of the concept of agro-processing parks—as in the case of industrial parks—is the possibility to overcome infrastructure shortcomings that make a value chain economically non-viable;
- development of rural micro-processing centres for agricultural produce (e.g. fruits and vegetables);
- provision of technical and managerial (entrepreneurship) know-how and training;
- establishment of recognized standards, accreditation, certification and inspection schemes, which are a prerequisite for (formal) export activities.

Integrated textile and wearing apparel value chains can also be an interesting thematic area for component 1 because of their huge potential for employment creation. Not only have they served as an entry point for many developing countries into manufacturing, Rwanda has also recorded measurable success in terms of job creation and export growth, with both picking up significantly (World Bank and Government of Rwanda, 2019). Changes in the structure of exports also support the country's efforts to diversify and upgrade its export base. Some progress has been achieved in this respect, as both export diversification and export sophistication increased, along with the share of manufactured goods in total exports, which more than doubled between 2010 and 2019 to 18 per cent

(see Figure 9). As is the case in agro-processing, the value chains of various textile industries still struggle with dysfunctional supply chains (as evidenced by a low share of processed industrial supplies, see Table 3), low capacity utilization, outdated machinery and, consequently, low labour productivity in the manufacturing sector by regional (i.e. intra-EAC) standards, amounting to roughly USD 5.300 in real terms in 2019 (see Figure 6), competition from imported second-hand garments,[47] high transportation costs and difficult access to international markets (e.g. due to NTMs), which was shown to be a major obstacle for doing business (see Figure 26). Taking into account the positive recent developments in the food and beverages industry and the remaining obstacles, potential entry points for interventions include:

- development of specialized industrial parks providing the appropriate infrastructure and potentially tax exemptions for exports;
- introduction of incentive programmes (including technical and management trainings or subsidies for capital investments) to register informal firms;
- initiation of international technology transfer programmes (as was recently concluded with India, administered by NIRDA);
- establishment of co-operatives (or community centres), possibly with a gender focus (such as the Nyamirambo Women's Centre, NWC), which manages logistics operations, in particular the sourcing of raw materials (e.g. cotton), which cannot always be obtained in sufficient quality or quantity, but also branding, marketing and quality controls;
- establishment of recognized standards, accreditation, certification and inspection schemes, which are a prerequisite for (formal) export activities.

b) Thematic component 2: Governance development

Industrialization is necessary to promote sustained growth by incentivizing economies of scale, innovation and the creation of backward and forward linkages with other sectors of the economy. Industrial policy plays a vital role to create the right conditions for industrialization. The diagnostics study has showed some promising areas of interventions that the PCP could target:

1) The widening of the statistics production of the country in the field of industrial data.
2) The strengthening of the evidence based industrial policy making through appropriate technical analytical support.
3) Capacity building of policy makers to increase the policy making effectiveness.

The role of the international organizations is important to provide the technical support that is necessary to accompany the country in the accomplishment of its policy objectives.

[47] This problem eased in 2017, with a raise of the tariffs for used clothes which, however, induced retaliation from the United States, which suspended its duty-free privileges on domestically manufactured apparel under the African Growth and Opportunity Act (AGOA) for Rwanda. See: https://www.ban.org/news/2019/6/24/the-circular-economy-how-rwanda-tries-to-chart-its-course-in-hostile-global-waters.

c) Thematic component 3: Development of sustainable energy

Like in any other economy, Rwanda's industrialization process needs to be fuelled by energy sources. Currently, however, about 80 per cent of energy needs are satisfied with biomass (wood). While this energy mix ensures a currently high share of renewables (87 per cent, see Figure 24) in total energy consumption, the situation may change as Rwanda develops and advances with the electrification of households and businesses. Any progress in terms of increasing access to electricity in the population, currently standing at about 35 per cent (see Figure 21), also needs to track the sources of electricity generation. The potential to improve the current access rate exists, as the country only uses a fraction of its hydropower and solar power capacity.

Rwanda's level of electricity is currently balanced with the rest of the world. However, it needs to import all its fuel requirements, a further incentive for the country to reduce the economy's carbon dependence and intensity. One important element of a sustainable industrialization process is therefore reliable and comprehensive renewable energy supply. Potential entry points for interventions include:

- intensified efforts to continue the country's electrification, especially in rural areas in line with the national target of a 100 per cent electrification rate of the country by 2024, as stipulated, for example, in the NST;
- further development of renewable energy sources, such as solar power, which are suitable to pursue off-grid electrification, which is part of the Rural Electrification Strategy (Ministry of Infrastructure, 2016). This approach would, at the same time, contribute to the aspired decoupling of the industrialization process from CO_2 and other greenhouse gas emissions.

d) Thematic component 4: Value added creation in a circular economy

Rwanda faces a series of environmental challenges ranging from coordinated waste management in view of increasing urbanization to the protection and conservation of the country's water and other natural reserves. Judging by the country's environmental policy strategies, Rwanda is determined to embark on a sustainable industrial development process, and compared to other countries in East Africa, Rwanda is a champion in promoting environmental sustainability (Figure 19). One of the guiding principles of Rwanda's National Environment and Climate Change Policy (Ministry of the Environment, 2019) is the gradual shift to a circular economy. The country's conception of a circular economy reflects that of the World Economic Forum, which characterizes a circular economy as one in which the end-of-life concept is replaced with the principles of restoration, shifts towards the use of renewable energy, the elimination of toxic chemicals that impede reuse and return to the biosphere, and the elimination of waste through the superior design of materials, products, systems and business models. The essence of the circular economy concept is that it tackles the omnipresent environmental externalities and at the same time creates opportunities for value creation. The current recycling rate in Kigali is still low, however, with estimates ranging from 2 per cent to 12 per cent (see Table 6), so there is still a long and arduous road ahead to reach the policy targets (for non-organic solid waste), which is set at 40 per cent by 2029/2030. Potential entry points for interventions include:

- improvement of recycling rates and waste disposal;
- reduction of the use of biomass (primarily wood) for household and industrial purposes to prevent further depletion of Rwanda's forests;
- increase the use of biodegradable materials in industrial products, which should be taken into account from the product design stage onwards;
- protection and conservation of water sources (especially wetlands), which is crucial for the full realization of the country's hydropower potential;
- piloting of cleaner production methods and ensuring that industrial waste dumped into lakes and rivers is treated properly, inter alia, by implementing the 'polluter pays' principle.

e) Thematic component 5: Adequate skills for Industry 4.0 and investment promotion for economic diversification

The key for reaping the benefits of the digital transformation and Industry 4.0 are skills. Irrespective of whether a country is an innovator, a producer or 'only' a user of advanced digital technologies, in all cases, it is the human factor that determines an economy's preparedness for Industry 4.0. In this respect, the initial conditions for Rwanda, where 80 per cent of the workforce only has basic skills or less (see Figure 16), and where global knowledge skills as well as vocational and technical skills are trailing behind even the African technological frontier (see Figure 15), is challenging. Yet there are some optimistic signs as well. The country scores high when it comes to people's perception of the alignment of their education with market needs (see Figure 18), which, on the one hand, suggests that the economy seems to have little demand for advanced digital skills, but may also reflect a positive attitude among the population, on the other. The latter may be fuelled by the current development of educational quality, which is on the rise (see Figure 18), with gradual, albeit slow, improvements in digital and IT infrastructure (see Figure 17). The plan to establish the Kigali Innovation City (Kigali Technopole), which aims to foster the development of the ICT industry, goes in the same direction. This is also true for the KLab *(knowledge lab)* project, which serves as an open technology hub in Kigali where students, recent graduates, entrepreneurs and innovators can convene and develop their ideas with the ultimate objective of turning them into viable projects.[48] More generally, the capital-skills complementarity requires parallel investments in both human skills and physical capital, including, but not limited to, public infrastructure. In this context, diversification efforts, that is, investments in new economic areas, could benefit from cooperation with foreign partners, either in the form of joint ventures or technology transfer programmes. The recently initiated pilot programme between NIRDA and India, the India Rwanda Innovation Growth Programme (IRIGP), is a good example of the latter. Against the background of the ambitious objectives for the development of the ICT industry, which is defined as a priority, and for digital transformation in general, but taking into account the current skill base and the existing capital equipment, the potential entry points for interventions include:

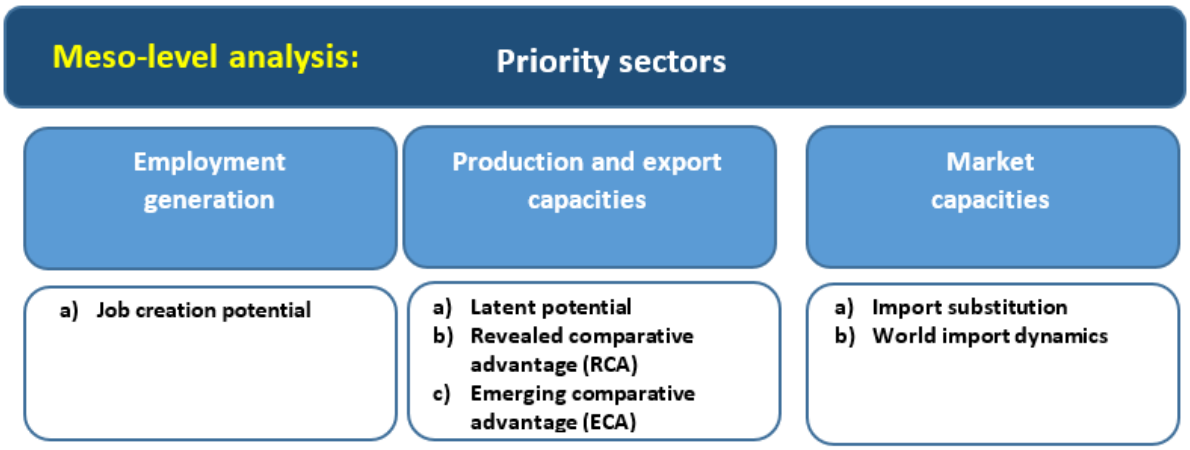
- design of curricula for vocational training programmes in line with the organizational and technological skill requirements of an increasingly digital economy;

[48] See: https://rwandagateway.com/o/kigali-innovation-city.

- encouraging the absorption of advanced production technologies throughout manufacturing industries;
- exploring methods and best practices to support small- and medium-sized enterprises (SMEs) in their technological upgrading process, which may consist of leapfrogging directly to Industry 4.0 or of gradually proceeding via mechanization and automation (the latter being associated with the third wave of industrialization);
- investment in skills, new capital and technologies via foreign direct investment (joint ventures) and technology transfer programmes with cooperation partners.

SECTION 2: IDENTIFICATION OF PRIORITY SECTORS

Whereas Chapter 1 analyses indicators at the macro level to identify the PCP's thematic components, a meso-analysis of the manufacturing sector is carried out in Chapter 2 to identify priority industries.

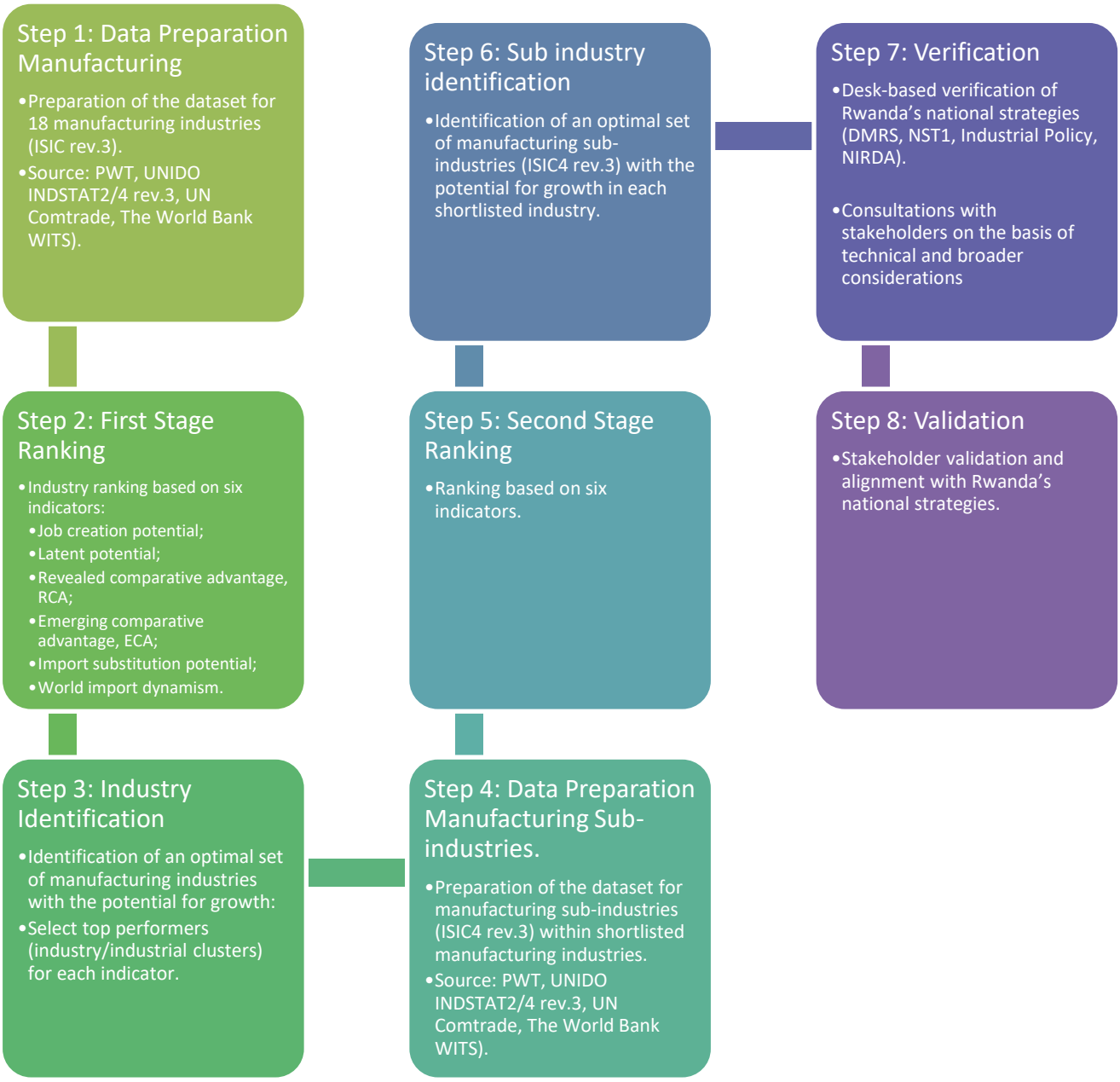


I. The Framework of Industry Prioritization

In this section manufacturing industries and sub-sectors are identified that have the potential to spur growth in Rwanda, based on a set of indicators: *Job creation potential* referring to *Employment generation*; *Latent potential*, *Revealed comparative advantage* (RCA) and *Emerging comparative advantage* (ECA) referring to *Production and export capacities*; *Import substitution* and *World import dynamism* referring to *Market analysis*.

Figure 27 presents the logical framework of the industry prioritization conducted in the chapter.

Figure 27: Logical framework of industry prioritization[49]



Source: UNIDO elaboration based on various sources.

[49] ISIC stands for International Standard Industrial Classification. ISIC2/4 stands for ISIC at 2 digits or 4 digits levels of disaggregation. INDSTAT is the UNIDO dataset of value added, employment and other industrial indicators. UN Comtrade is the UN trade dataset of goods. WITS is the World Integrated Trade Solutions platform from the World Bank to download trade data. PWT is the Penn World Table of economic indicators. DMRS stands for Domestic Market Recapturing Strategy, NST is the Rwanda National Strategy of Transformation, NIRDA is the National Industrial Research and Development Agency.

a) Preparation of datasets

The datasets for manufacturing value added, employment and exports are based on the international classification of manufacturing activities (ISIC2 rev.3, UNIDO, 2013)[50].

b) First stage ranking and industry identification

The following indicators are applied to the data:

- **Indicator 1 (Job creation potential)**. This indicator determines the "average" pattern of employment creation in different industries at global level based on available employment data. We derive the job creation potential of each manufacturing industry at different levels of income (see Appendix to Section 2). The job creation potential of manufacturing industries is ranked in accordance with Rwanda's level of per capita income (Int$ 1,460 PPP) to obtain an optimal set of industries with the potential for job creation in Rwanda.
- **Indicator 2 (Latent potential)**. This indicator establishes the "average" export patterns[51] of different industries in low- and middle-income countries and identifies industries with a "latent potential", i.e., industries that require an intervention to improve their performance, promote the achievement of average LMI levels and rapid catching up.
- **Indicator 3 (Revealed comparative advantage, RCA).** RCA calculates the relative advantage of an economy in given industries by comparing the country's trade patterns with the world average.[52] Country i has a comparative advantage if its share of industrial exports in total exports exceeds the aggregate world export share, i.e. if its $RCA_{ij} > 1$.
- **Indicator 4 (Emerging comparative advantage, ECA).** The calculation used to determine an economy's emerging comparative advantage (ECA) is similar to RCA's. ECA identifies industries with a rising comparative advantage (i.e., with an RCA_{ij} between 0.3 and 0.9, indicating a tendency for strong growth). Industries with an RCA lower than 1, but that post strong growth reflect a country's emerging capabilities and show promising industrial potential.
- **Indicator 5 (Import substitution).** This indicator explores the share of imports in Rwanda's industries. We focus on Rwanda's import structure in 2019 to determine the level of domestic demand for specific manufactured goods, and identify industries with the highest amount of imports, flagging potential for Rwanda's industries to meet national demand with local products.

[50] Trade data are not directly downloaded according to the ISIC classification but converted to ISIC on the basis of internationally recognized concordance tables.

[51] Manufacturing value added data is usually used for this indicator. Due to the lack of available manufacturing value added data at the manufacturing 2-digit level, we use gross world exports as an alternative variable. The results should be interpreted with caution, however, as net exports (gross exports net of re-exports) would in fact be a more suitable variable, but the lack of data on re- exports for the majority of countries would limit the dataset's explanatory value.

[52] The concept of revealed comparative advantage (RCA) is based on Balassa (1965) and is derived by calculating the export share of product x_{ij} relative to all exports X_{ij} from country i to the rest of the world j in proportion to the global share of exports of the respective good x . $RCA_{ij} = \frac{x_{ij}/X_{ij}}{x^k/X}$

- **Indicator 6 (World import dynamism).** World import dynamism reflects the manufacturing industries with highest growth rate in world imports (2010–19). The selection of an industry based on world import growth rate or "market dynamism" implies that "the market signals are being read".

We identify an optimal set of manufacturing industries out of a total of 18 industries in Rwanda that have the potential for growth.

c) Second stage ranking and industry identification

Using the list of manufacturing industries identified in the first stage, we rank the manufacturing sub-sectors within each shortlisted industry at a more disaggregated level (at ISIC4 rev.3) by applying the same indicators as in the first ranking exercise.

d) Verification

Each shortlisted industry's potential is analysed to substantiate its feasibility based on global and domestic trends, the availability of technological capabilities, and the Rwandan government's previous policy decisions.

e) Validation with counterparts

Stakeholder and expert opinions were sought in cases of paucity of evidence. Some industries may have been eliminated from the original list. Likewise, other industries with the potential for future growth that are less obvious based on the analysis of historic data during the desk-based research phase may have been added.

II. Discussion on Findings

a) Job creation potential

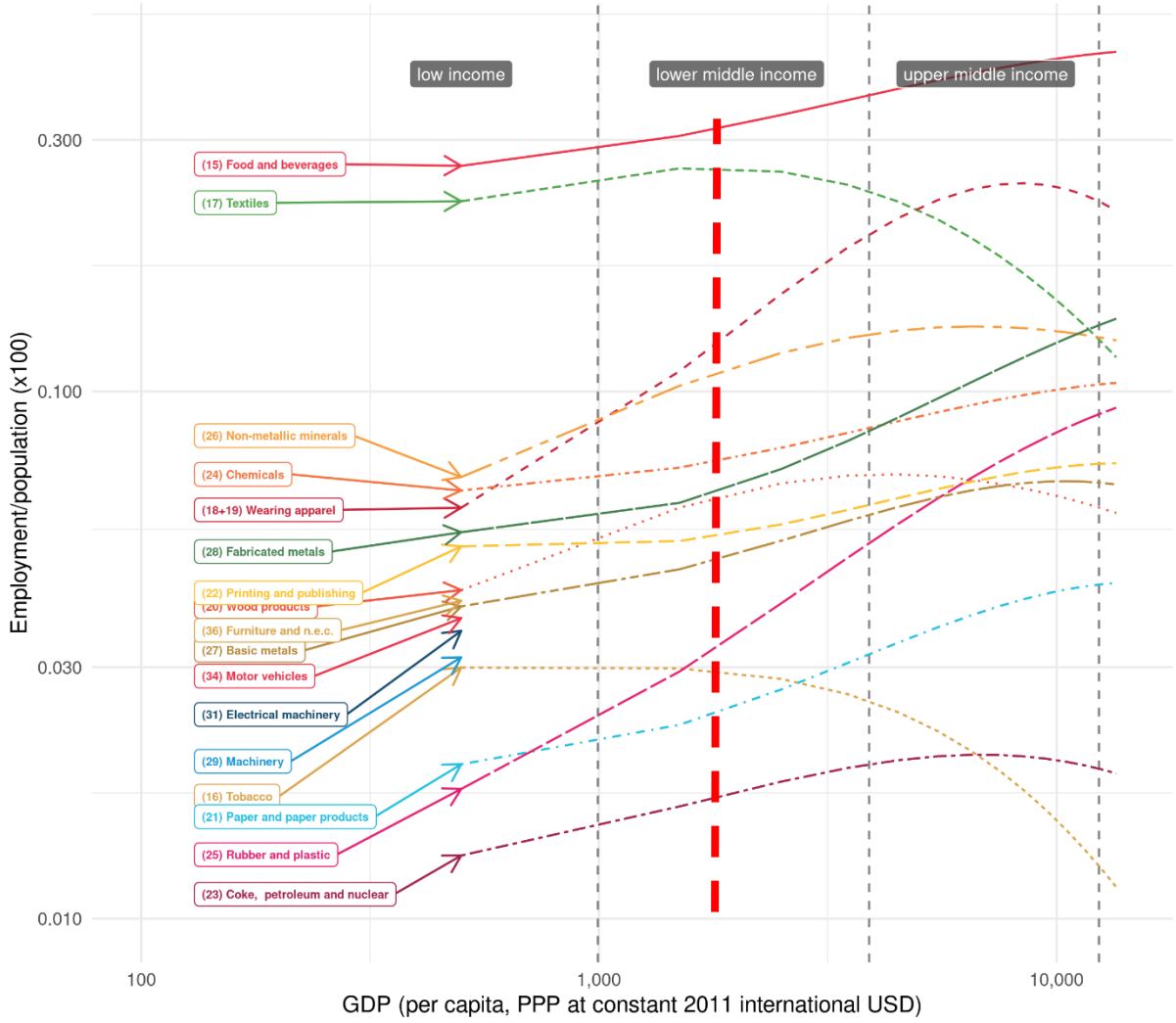
Structural change reflects the distinctive trajectories industries follow in terms of value added, employment or exports as a country's income level rises. Several country-specific factors influence the trajectory of structural change. Structural change in manufacturing is attributable to (i) changes in demand and supply associated with income level; (ii) a country's given demographic and geographic conditions, and (iii) a country's overall conditions. Lower income countries tend to focus on relatively labour- or resource-intensive activities, while higher income countries are more likely to engage in capital-intensive and/or technology-intensive industries.

Patterns of structural change in the manufacturing sector can be identified by summarizing data on employment and GDP per capita for a sample of countries. Employment patterns are useful for identifying employment-intensive industries and the potential for job creation given a certain GDP per capita level. The employment dimension of structural change in the manufacturing sector is illustrated in Figure 28.

Rwanda's per capita income level (red line) was around Int$ 1,460 (constant 2011, PPP) in 2019, i.e., the country is in the expansive stages of industrial development (i.e. similar to countries with per capita income levels of less than Int$ 3,000).

The three major sources of manufacturing employment in the initial stages of industrial development are food and beverages as well as textiles and wearing apparel. The food and beverages industry provides a stable source of employment in all countries, regardless of income level. The textile industry creates jobs at earlier stages of development, but unlike the food and beverages industry, textiles and wearing apparel have comparatively lower levels of employment after peaking in the second stage of development (around Int$ 9,000 per capita income).

Figure 28: Patterns of manufacturing employment



Source: UNIDO elaboration based on UNIDO INDSTAT2 rev.3.

Food and beverages and textiles are low-tech, labour-intensive industries that develop rapidly at a relatively early stage of development (Table 11). At Rwanda's per capita income level of around Int$ 1,460, its current level of employment in the food and beverages industry (0.31) suggests that the industry could, on average, create jobs for 0.31 per cent of the population.

Table 11: Patterns of manufacturing employment (Employment-to-population ratio)

Rwanda		
Criteria 1: Job creation potential (highest value)		
ISIC 2 rev.3	Description	Employment to population ratio (%)
15	Food and beverages	0.3052
16	Tobacco	0.0298
17	Textiles	0.2649
18	Wearing apparel, fur	0.1093
19	Leather, leather products and footwear	0.1093
20	Wood products	0.0602
21	Paper	0.0233
22	Printing and publishing	0.0520
23	Coke and refined petroleum	0.0163
24	Chemicals	0.0717
25	Rubber and plastic	0.0294
26	Non-metallic minerals	0.1025
27	Basic metals	0.0460
28	Fabricated metals	0.0615
29	Machinery and equipment	0.0359
30	Office, accounting and computing machinery	0.0040
31	Electrical machinery and apparatus	0.0375
32	Radio, television and communication equipment	0.0040
33	Medical, precision and optical instruments	0.0040
34	Motor vehicles, trailers, semi-trailers	0.0478
35	Other transport equipment	0.0478
36	Furniture; manufacturing n.e.c.	0.0481

Source: UNIDO elaboration based on UNIDO INDSTAT2 rev.3.

b) Latent potential

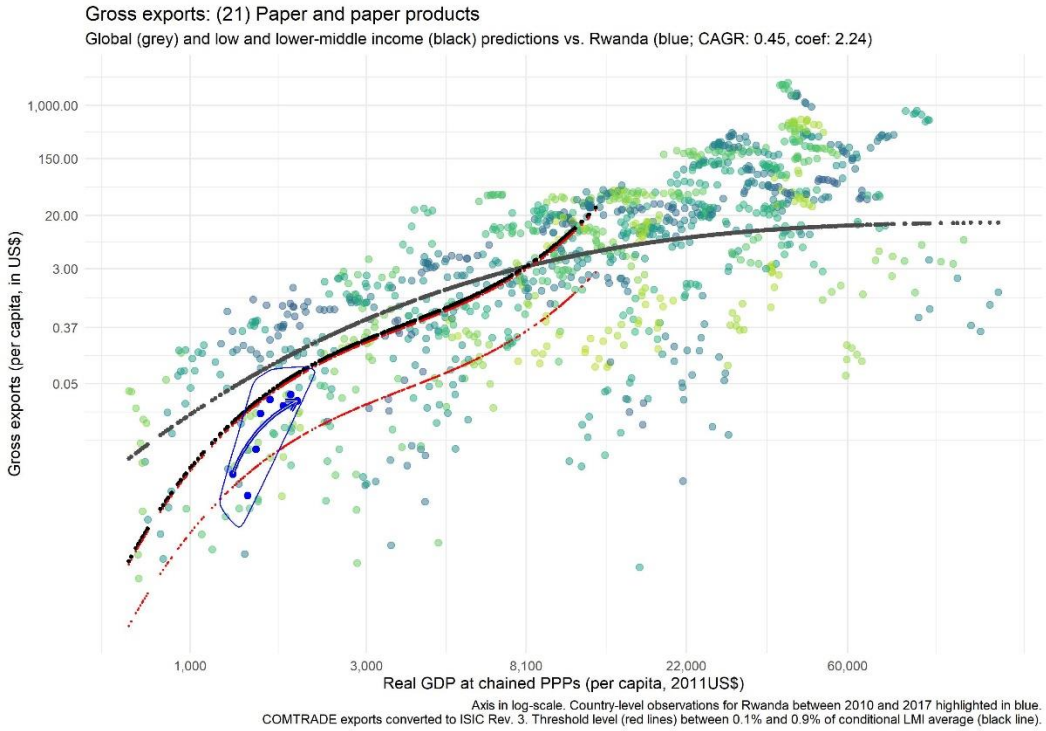
Similar patterns can be estimated by using different variables that are of policy relevance. Manufactured exports, for example, are a key variable in this regard.

The identification of patterns helps detect “latent” comparative advantages of specific manufacturing industries and their potential for growth. A comparison of Rwanda’s export performance and the patterns of manufactured exports of comparators at similar levels of GDP per capita is useful for policymakers to better understand manufacturing industries’ relative export performance.

Figure 29 and Figure 30 present the estimated patterns of different manufacturing industries, allowing us to assess the “average” export performance of low- and middle-income countries (black curve) as well as global trends (grey curve).

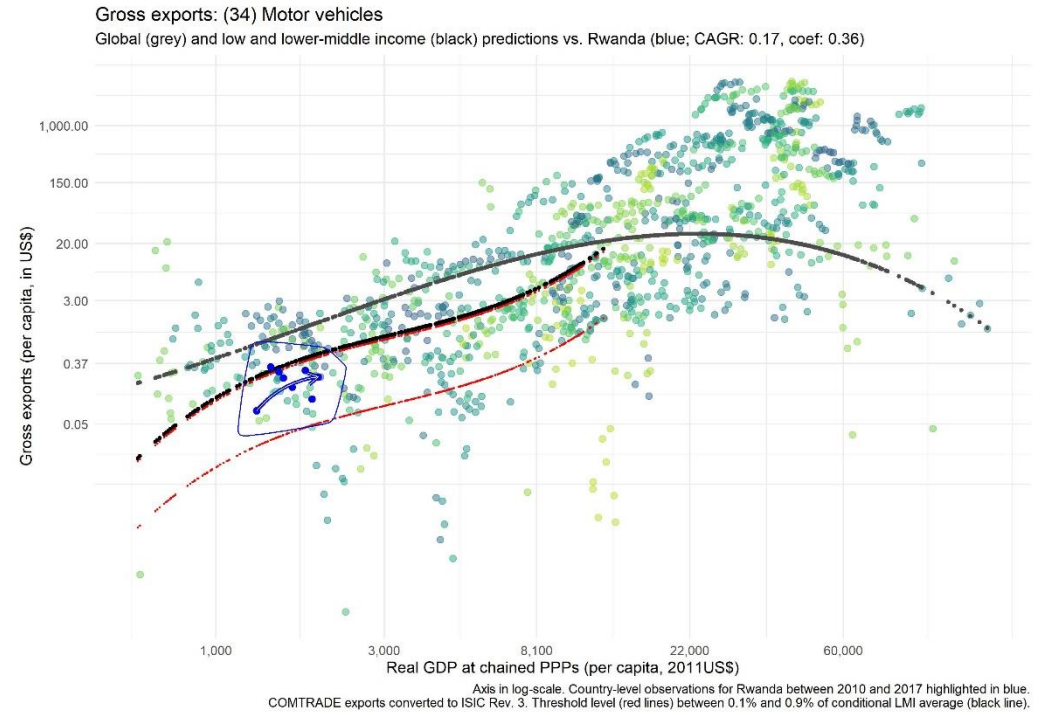
If Rwanda’s actual export performance (blue dots) lies below the average performance of lower middle-income comparators (black curve), but the growth rate of its exports is rapidly increasing, Rwanda has the potential to improve its export performance relative to that of other countries with similar levels of per capita income. Given the specific country conditions, Rwanda’s comparative advantage is still “latent” due to its untapped potential to increase industries’ export performance. The red curve represents a lower bound threshold to exclude as potentially attractive those sectors with growing exports but still a low level of gross exports per capita.

Figure 29: Patterns of manufactured exports in the paper industry for Rwanda and its comparators



Source: UNIDO elaboration based on UN Comtrade (2020).

Figure 30: Patterns of manufactured export in the motor vehicles industry for Rwanda and its comparators



Source: UNIDO elaboration based on UN Comtrade (2020).

Figure 29 and Figure 30 present the patterns of manufactured exports of two industries that are underperforming, namely paper and motor vehicles, but that have the potential to grow more rapidly than other industries if the country follows the average development path of exports in the future.

Rwanda's labour-intensive industries are characterized by higher levels of gross exports (per capita) and growth because the country can leverage cheap and abundant labour. Since Rwanda will eventually reach a higher level of income, the possibility of engaging in capital-intensive industries will arise, while the relevance of labour-intensive industries will decline. This trajectory has been followed by many industrialized countries, including the "Four Asian Tigers".

Table 12: Patterns of manufactured exports growth

Rwanda			
Criteria 2: Latent potential (strong latent potential with the highest growth rate of gross exports)			
ISIC 2 rev.3	Description	Latent potential	Growth rate of gross export (2005-17)
15	Food and beverages	Strong	27%
16	Tobacco	-	-
17	Textiles	Strong	-2%
18	Wearing apparel, fur	Strong	13%
19	Leather, leather products and footwear	Strong	13%
20	Wood products	Strong	3%
21	Paper	Strong	45%
22	Printing and publishing	Strong	-3%
23	Coke and refined petroleum	Moderate	21%
24	Chemicals	Strong	19%
25	Rubber and plastic	Strong	12%
26	Non-metallic minerals	Moderate	20%
27	Basic metals	Moderate	61%
28	Fabricated metals	Moderate	7%
29	Machinery and equipment	Weak	2%
30	Office, accounting and computing machinery	Weak	2%
31	Electrical machinery and apparatus	Moderate	20%
32	Radio, television and communication equipment	Weak	2%
33	Medical, precision and optical instruments	Weak	2%
34	Motor vehicles, trailers, semi-trailers	Moderate	17%
35	Other transport equipment	Moderate	9%
36	Furniture; manufacturing n.e.c.	Moderate	14%

Source: UNIDO elaboration based on UNIDO INDSTAT2 rev.3.
Note: Strong latent potential indicates Rwanda's actual export performance lies below the average performance of lower middle-income comparators. The opposite is the case for weak latent potential. Growth rate represents the cumulative annual growth rate (CAGR) of the period.

Table 12 highlights the set of manufacturing industries that Rwanda has latent export potential in (Rwanda is underperforming relative to lower middle-income comparators). When we examine the potential growth of these industries, paper (42 per cent) and motor vehicles (34 per cent) seem to be growing more rapidly than other industries.

c) Revealed comparative advantage (RCA)

RCA allows us to identify those manufacturing industries that Rwanda has a comparative advantage in, and which are attractive from a trade perspective (RCA > 1). Table 13 identifies five manufacturing industries that Rwanda has a comparative advantage in (i.e., Rwanda's share of exports is higher than the world export share). They are 1) food and beverages; 2) leather; 3) coke and refined petroleum; 4) non-metallic minerals, and 5) basic metals.

It comes as no surprise that these industries are labour-intensive and resource-based, as many countries with a similar level of income as Rwanda (low- to lower middle-income countries) manifest their comparative advantage in these industries due to their abundant labour force and the relatively low factor costs (UNIDO, 2013). It is worth noting that because the production processes in these countries are labour-intensive, far more workers (particularly female workers) can find employment, which contributes to the creation of formal manufacturing jobs with decent wages. Probably triggered by increasing demand for building materials in Rwanda, the non-metallic minerals industry (such as cement and ceramic products) and the basic metal industry (such as steel metal) are the two fastest growing manufacturing industries in the country, manifested in the RCA level and growth rate. Table 13 shows that the RCA of basic metals is 2.79 (21.11 per cent growth, 2015–2019) and that of non-metallic minerals is 1.52 (11.50 per cent growth, 2015–2019).

Table 13: Revealed comparative advantage (RCA) and emerging RCA for Rwanda

Rwanda			
		Criteria 3: Revealed comparative advantage (highest value)	Criteria 4: Emerging comparative advantage (RCA between 0.3 and 0.9 with the highest growth rate)
ISIC 2 rev.3	Description	Revealed comparative advantage, RCA (2019)	RCA growth rate (2015-19)
15	Food and beverages	1.8425	-8.82%
16	Tobacco	0.0134	72.77%
17	Textiles	0.3050	27.69%
18	Wearing apparel, fur	0.3210	37.96%
19	Leather, leather products and footwear	1.0423	33.36%
20	Wood products	0.0766	-18.04%
21	Paper	0.1170	12.17%
22	Printing and publishing	0.1217	4.87%
23	Coke and refined petroleum	1.1200	146.70%
24	Chemicals	0.0361	-5.33%
25	Rubber and plastic	0.1234	-1.86%
26	Non-metallic minerals	1.5175	11.50%
27	Basic metals	2.7925	21.11%
28	Fabricated metals	0.1106	2.48%
29	Machinery and equipment	0.0711	-5.85%
30	Office, accounting and computing machinery	0.0902	19.07%
31	Electrical machinery and apparatus	0.1350	7.75%
32	Radio, television and communication equipment	0.0484	-21.05%
33	Medical, precision and optical instruments	0.1063	-1.58%
34	Motor vehicles, trailers, semi-trailers	0.2870	0.93%
35	Other transport equipment	0.1719	-23.29%
36	Furniture; manufacturing n.e.c.	0.9508	-5.72%

Source: UNIDO elaboration based on UN Comtrade (2020) and The World Bank WITS (2020). Growth rate represents the cumulative annual growth rate (CAGR) of the period.

d) Emerging comparative advantage (ECA)

Industries with an emerging comparative advantage (manufacturing industries with an RCA between 0.3 and 0.9, and a tendency for strong growth) (Table 13) are textiles (RCA of 0.3, 27.7 per cent growth, 2015–2019) and wearing apparel (RCA of 0.32, 38 per cent growth, 2015–2019). Rwanda has an emerging comparative advantage in the leather industry (RCA 1.04, 33.36 per cent, 2015-2019), with its RCA slightly above 0.9. Furthermore, Rwanda also indicates a growing export advantage in motor vehicles (RCA 0.28, 0.93 per cent growth, 2015-2019), although its RCA slightly fell to below 0.3.

e) Import substitution

The share of imports by industry reveals Rwanda's potential for import substitution. By focusing on Rwanda's import structure in 2019, we identify domestic demand for specific goods and import substitution opportunities for Rwandan industries to foster the generation of domestic value added.

Table 14 shows that coke and refined petroleum (USD 467 million), food and beverages (USD 417 million), and chemicals (USD 358 million) had the highest share of imports in Rwanda in 2019. Clearly, Rwanda's endowment provides a comparative advantage and an optimal industrial structure for some but not all its industries.

Table 14: Import substitution potential and world import dynamism potential for Rwanda

Rwanda			World
		Criteria 5: Import substitution (highest value)	Criteria 6: World import dynamism (highest value)
ISIC 2 rev.3	Description	Import (USD) 2019	World import growth rate (2010-19)
15	Food and beverages	417,000,000	1.71%
16	Tobacco	3,834,421	1.20%
17	Textiles	80,100,000	0.79%
18	Wearing apparel, fur	27,300,000	1.87%
19	Leather, leather products and footwear	42,700,000	2.72%
20	Wood products	18,800,000	0.89%
21	Paper	53,300,000	-1.12%
22	Printing and publishing	25,100,000	0.24%
23	Coke and refined petroleum	467,000,000	-0.85%
24	Chemicals	358,000,000	1.15%
25	Rubber and plastic	86,000,000	2.15%
26	Non-metallic minerals	136,000,000	0.85%
27	Basic metals	149,000,000	0.71%
28	Fabricated metals	218,000,000	2.27%
29	Machinery and equipment	277,000,000	1.59%
30	Office, accounting and computing machinery	55,100,000	0.61%
31	Electrical machinery and apparatus	162,000,000	1.99%
32	Radio, television and communication equipment	102,000,000	-0.46%
33	Medical, precision and optical instruments	56,100,000	1.13%
34	Motor vehicles, trailers, semi-trailers	196,000,000	2.87%
35	Other transport equipment	30,000,000	3.03%
36	Furniture; manufacturing n.e.c.	48,100,000	1.88%

Source: UNIDO elaboration based on UN Comtrade (2020) and The World Bank WITS (2020). Growth rate represents the cumulative annual growth rate (CAGR) of the period.

Among the three manufacturing industries with the highest share of imports, chemicals plays a unique role because it not only meets basic needs, but also contributes to the creation of formal

manufacturing jobs with decent wages across all stages of development; in other words, it serves as an incubator and accelerator for other manufacturing activities and manufacturing-related services, such as agro-processing, biotech and pharmaceuticals.

Rwanda's manufacturing sector has the capacity to meet a certain level of demand for basic chemical products, for example, agrochemicals and fertilizers, to modernize its agricultural sector and to produce colouring matters and tanning agents, which are primary sources for the textile and wearing apparel industries, and both of which are major contributors to value added at early stages of industrial development. This represents an opportunity for Rwanda to further develop its domestic chemical industry.

At low- and lower middle-income levels, primary chemical sub-sectors emerge to supply household- and agrochemical products to meet domestic demand, including soaps, cleaning products, cosmetics and fertilizers, just to name a few. Such sub-sectors play an important role in terms of their contribution to the generation of value added and job creation, especially in those countries undergoing a structural transformation from an agrarian-based economy to one that includes industries with higher levels of productivity and complexity.

f) World import dynamism

By calculating the growth rate of world manufacturing imports (2010-19) (Table 14), we find that automotive and transport equipment industries have the highest growth rate at 2.87 per cent and 3 per cent, respectively.

It should be noted that in countries like Rwanda with a population of around 12.3 million—and considering the country's geographic location and proximity to major markets—the automotive industry (especially manufacturing sub-sectors supplying automotive parts, motorcycles and assembling light auto vehicles for the regional market) has the potential of becoming one of the largest industries in the middle stage of development.

Large regional markets nurture the automotive industry which relies on economies of scale. Moreover, multinational corporations tend to build manufacturing and assembly plants in countries with favourable economic conditions and establish regional hubs to serve smaller countries in the region (exports).

Rwanda could benefit from its geographical proximity to Eastern African markets by entering regional markets, which are opening up due to the loss in competitiveness of large international exporters (such as China). Furthermore, there is potential for the relocation of firms from comparator countries to Rwanda, which would generate transfers of knowledge, incubate local industry eco-system, and unlock access to international markets. Motor vehicles, trailers, semi-trailers, and other transport equipment demonstrate the strongest world import dynamism.

Table 15: Empirical findings of industry prioritization for Rwanda

		Rwanda						
	Criteria	Revealed comparative advantage (highest value)	Emerging comparative advantage (RCA between 0.3 and 0.9 with the highest growth rate)	Job creation potential (highest value)	Latent potential (strong latent potential with the highest growth rate of gross exports)		Import substitution (highest value)	Word import dynamism (highest value)
ISIC 2 rev.3	Description	Revealed comparative advantage, RCA (2019)	RCA growth rate (2015-19)	Employment to population ratio (%)	Latent export potential	Growth rate of gross exports (2005-17)	Import (USD) 2019	World import growth rate (2010-19)
15	Food and beverages	1.8425	-8.82%	0.3052	Strong	27%	417,000,000	1.71%
16	Tobacco	0.0134	72.77%	0.0298	-	-	3,834,421	1.20%
17	Textiles	0.3050	27.69%	0.2649	Strong	-2%	80,100,000	0.79%
18	Wearing apparel, fur	0.3210	37.96%	0.1093	Strong	13%	27,300,000	1.87%
19	Leather, leather products and footwear	1.0423	33.36%	0.1093	Strong	13%	42,700,000	2.72%
20	Wood products	0.0766	-18.04%	0.0602	Strong	3%	18,800,000	0.89%
21	Paper	0.1170	12.17%	0.0233	Strong	45%	53,300,000	-1.12%
22	Printing and publishing	0.1217	4.87%	0.0520	Strong	-3%	25,100,000	0.24%
23	Coke and refined petroleum	1.1200	146.70%	0.0163	Moderate	21%	467,000,000	-0.85%
24	Chemicals	0.0361	-5.33%	0.0717	Strong	19%	358,000,000	1.15%
25	Rubber and plastic	0.1234	-1.86%	0.0294	Strong	12%	86,000,000	2.15%
26	Non-metallic minerals	1.5175	11.50%	0.1025	Moderate	20%	136,000,000	0.85%
27	Basic metals	2.7925	21.11%	0.0460	Moderate	61%	149,000,000	0.71%
28	Fabricated metals	0.1106	2.48%	0.0615	Moderate	7%	218,000,000	2.27%
29	Machinery and equipment	0.0711	-5.85%	0.0359	Weak	2%	277,000,000	1.59%
30	Office, accounting and computing machinery	0.0902	19.07%	0.0040	Weak	2%	55,100,000	0.61%
31	Electrical machinery and apparatus	0.1350	7.75%	0.0375	Moderate	20%	162,000,000	1.99%
32	Radio, television and communication equipment	0.0484	-21.05%	0.0040	Weak	2%	102,000,000	-0.46%
33	Medical, precision and optical instruments	0.1063	-1.58%	0.0040	Weak	2%	56,100,000	1.13%
34	Motor vehicles, trailers, semi-trailers	0.2870	0.93%	0.0478	Moderate	17%	196,000,000	2.87%
35	Other transport equipment	0.1719	-23.29%	0.0478	Moderate	9%	30,000,000	3.03%
36	Furniture; manufacturing n.e.c.	0.9508	-5.72%	0.0481	Moderate	14%	48,100,000	1.88%

Source: UNIDO elaboration based on UN Comtrade (2020), The World Bank WITS (2020), and UNIDO INDSTAT2/4 rev.3.
Note: Strong latent potential indicates that Rwanda's actual export performance lies below the average performance of lower middle-income comparators. The opposite is the case for weak latent potential. Growth rate represents the cumulative annual growth rate (CAGR) of the period.

III. Industry Prioritization for Rwanda

Due to Rwanda's relatively small size (with a population of around 12.3 million) and the significance of inclusive development and job creation, Rwanda's priority industries should be those that have a strong potential for job creation, export growth, import substitution and that can meet world demand.

Given the forward-looking potential for Rwanda's income range (potential for job creation and export latency) based on industrial development patterns and the backward-looking assessment of Rwanda's past export performance (potential of RCA and ECA) and import structure (potential of import substitution and world import dynamism) (Table 16), Rwanda has a strong development potential in food and beverages, textiles, wearing apparel, leather, paper, coke and refined petroleum, chemicals, non-metallic minerals, basic metals and possibly even in motor vehicles and other transport equipment.

Table 16: Priority manufacturing industries for Rwanda

ISIC 2 rev.3	Manufacturing industries	Potential
15	Food and beverages	Job creation
17	Textiles	Job creation
18	Wearing apparel, fur	Emerging comparative advantage (ECA)
19	Leather, leather products and footwear	Emerging comparative advantage (ECA)
21	Paper	Latent potential
23	Coke and refined petroleum	Import substitution
24	Chemicals	Import substitution
26	Non-metallic minerals	Revealed comparative advantage (RCA)
27	Basic metals	Revealed comparative advantage (RCA)
34	Motor vehicles, trailers, semi-trailers	World import dynamism
35	Other transport equipment	World import dynamism

Source: UNIDO elaboration based on empirical findings.

Food and beverages, as well as textiles tend to have strong potential in terms of job creation, as these industries absorb excess labour that has been freed up by the agricultural sector, characterized by low productivity, as the pace of industrialization of agrarian-based economies accelerates.

The non-metallic mineral industry will also expand as Rwanda's income increases and as demand for the industry's products rises, primarily from the domestic market (expansion of public infrastructure and housing developments). The basic metal industry is one of a few already successful manufacturing industries compared to the average performance of this industry in countries with a similar income level as Rwanda. The basic metal industry is more capital-intensive, however, and only offers limited potential for job creation due to its high material-intensive and resource-based production processes, which might furthermore pose an environmental risk.

The chemical industry not only rapidly increases its MVA contribution to GDP due to its fast growth in labour productivity, it can already emerge at an early stage of industrial development because of its

specific characteristics (high domestic demand for basic necessities, agro-processing chemicals and fertilizers).

With a view to both growth and inclusiveness, food and beverages, textiles, wearing apparel, leather, and chemicals should be Rwanda's priority in its industrialization efforts. The rapid growth of these priority industries could generate a high number of formal manufacturing jobs (including female employment), stimulate domestic consumption, increase tax revenue and investments in infrastructure and education (vocational training), thereby building a solid foundation for the development of other manufacturing and related service industries to facilitate structural change and drive Rwanda's catching up process.

Low wages and Rwanda's young labour force could be assets in terms of cost competitiveness. Labour-intensive industries and cost competitiveness are decisive factors for success in prioritized "early stage" manufacturing industries.

Rwanda's competitive wage level and abundant trainable labour force already provide a distinct advantage not found in many countries, especially in those with higher levels of GDP per capita. Rwanda will not be competing with industrialized countries in machinery, electronics and other high-tech industries, but has the potential of entering the international market with textiles and wearing apparel, i.e., with products from industries that developed countries have already lost competitiveness in.

Countries that have recently experienced rapid industrialization, e.g. Viet Nam, rarely witnessed sudden changes to their economic structure, or leapfrogging from an agrarian economy to one driven by capital-intensive or high-tech manufacturing industries (Haraguchi, 2015). Successful countries that have considerably reduced poverty, improved the well-being of their populations, and modernized their economy in a relatively short period of time scored initial successes with export-oriented light manufacturing industries and continued investing in infrastructure and human capital to achieve industrial upgrading (for example, Malaysia, the Republic of Korea, Mauritius, China and Viet Nam, and before them, the majority of industrialized countries, including the United Kingdom and Japan).

Thus, accelerating industrialization and improvements in living conditions are possible, but development strategies must incorporate a structural change perspective, taking country-specific conditions and comparative advantage into consideration.

IV. Desk-based Validation (Rwanda's National Strategies)

Eleven manufacturing sectors have been identified in the previous section based on six economic indicators. We can group these eleven manufacturing industries into five industrial clusters (i) construction materials, (ii) light manufacturing, (iii) agro-processing, (iv) petrochemicals, and (v) logistics and transportation (see Column 1, Table 17). In a next step, we conduct a desk-based verification of the list of economic activities prioritized in Rwanda's national strategies (see Columns 2-5, Table 17).

The purpose of a national strategy is to position the country in the long term with the aim of improving its economic performance. It proposes a unique set of activities that are difficult to imitate by others, if at all. That is, the purpose of a national strategy is to identify and foster activities that differentiate the country from others. It involves establishing priorities and determining the country's future direction, including which manufacturing industries to target, specifying existing industries' future development and goals, the types of new products to be manufactured, and which markets to serve.

It is worth mentioning that a 7-year government programme (2017–2024) was rolled out, which coincides with the implementation of the Economic and Poverty Reduction Strategy (EDPRS2, 2013–18) and Vision 2020 (which will cover the first four years of Vision 2050, a new 30-year vision for the period up to 2050).

Table 17: List of priority manufacturing industries identified by UNIDO's Industrial Diagnostic and economic activities prioritized in Rwanda's national strategies

Column	1		2	3	4	5
Industrial clusters	Priority industries identified by UNIDO's Industrial Diagnostic (2020)		Industries prioritized in Rwanda's Domestic Market Recapturing Strategy (DMRS, 2015)	Economic activities prioritized in Rwanda's National Strategy for Transformation (NST1, 2011)	Industrial activities prioritized in Rwanda's Industrial Policy (2011)	Value chain identified in Rwanda's National Industrial Research and Development Agency (NIRDA)
Construction materials	2610 Manufacture of glass and glass products 2691 Manufacture of non-structural non-refractory ceramic ware 2692 Manufacture of refractory ceramic products 2693 Manufacture of structural non-refractory clay and ceramic products 2694 Manufacture of cement, lime, and plaster 2695 Manufacture of articles of concrete, cement, and plaster 2696 Cutting, shaping and finishing of stone 2699 Manufacture of other non-metallic mineral products n.e.c.	ISIC 26: Non-metallic minerals Sub-sectors: 2610, 2691, 2692, 2693, 2694, 2695, 2696, 2699	Cement Ceramic/granite tiles Plastic tube/construction materials	Value addition and processing of mining products	Commodities and services Minerals Processing and value addition Construction materials (including Cement) Mineral processing	N/A N/A
	2710 Manufacture of basic iron and steel 2720 Manufacture of basic precious and non-ferrous metals	ISIC 27: Basic metals Sub-sectors: 2710, 2720	Steel and iron Aluminium products		Medium- to high-tech manufactures Building materials (including metal parts and structures)	N/A
	2422 Manufacture of paints, varnishes, and similar coatings, printing ink and mastics	ISIC 24: Chemicals (paints and varnishes only) Sub-sectors: 2422	Paints and varnishes	N/A	N/A	N/A
Light manufacturing	1711 Preparation and spinning of textile fibres; weaving of textiles 1721 Manufacture of made-up textile articles, except apparel 1722 Manufacture of carpets and rugs 1723 Manufacture of cordage, rope, twine and netting	ISIC 17: Textiles ISIC 18: Wearing apparel, fur ISIC 19: Leather, leather products and footwear Subsectors: 1711, 1721, 1722, 1723, 1729, 1730, 1810, 1820, 1911, 1912, 1920	Textiles and garments	Textiles and garments Leather	Processing and value addition Textiles (including silk, leather and leather goods) Silk	Garment value chain

	1729	Manufacture of other textiles n.e.c.					
	1730	Manufacture of knitted and crocheted fabrics and articles					
	1810	Manufacture of wearing apparel, except fur apparel					
	1820	Dressing and dyeing of fur; manufacture of articles of fur					
	1911	Tanning and dressing of leather					
	1912	Manufacture of luggage, handbags and the like, saddlery and harness					
	1920	Manufacture of footwear					
	2101	Manufacture of pulp, paper and paperboard	ISIC 21: Paper Sub-sectors: 2101, 2102, 2109	Packaging materials	N/A	Medium- to high-tech manufactures Bioplastics	N/A
	2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard					
	2109	Manufacture of other articles of paper and paperboard					
	2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds	ISIC 24: Chemicals (excl. paints and varnishes, and fertilizer) Sub-sectors: 2411, 2413, 2421, 2423, 2424, 2429, 2430	Pharmaceuticals Soap and detergents Reagents Insecticides Beauty/make up preparations	N/A	Low-tech manufactures Pharmaceuticals Chemical products (excl. fertilizer)	N/A
	2413	Manufacture of plastics in primary forms and of synthetic rubber					
	2421	Manufacture of pesticides and other agrochemical products					
	2423	Manufacture of pharmaceuticals, medicinal chemicals, and botanical products					
	2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations					
	2429	Manufacture of other chemical products n.e.c.					
	2430	Manufacture of man-made fibres					
	N/A		N/A	Wooden furniture Hand tools	N/A	N/A	Wood processing and bamboo value chain

Agro-processing	1512	Processing and preserving of fish and fish products	ISIC 15: Food and beverages Sub-sectors: 1512, 1513, 1514, 1520, 1531, 1533, 1541, 1542, 1543, 1549, 1551, 1554	Sugar Edible oils Rice Dried fish/aquaculture Maize	Meat and dairy Horticulture	Processing and value addition Agro-processing (including pyrethrum, dairy, vegetable oil, soaps and detergents)	Banana wines value chain Poultry value chain Fruit and vegetable value chain Animal feed value chain
	1513	Processing and preserving of fruit and vegetables					
	1514	Manufacture of vegetable and animal oils and fats					
	1520	Manufacture of dairy products					
	1531	Manufacture of grain mill products					
	1533	Manufacture of prepared animal feeds					
	1541	Manufacture of bakery products					
	1542	Manufacture of sugar				Commodities and services Commodities (including tea and coffee)	
	1543	Manufacture of cocoa, chocolate and sugar confectionery					
	1549	Manufacture of other food products n.e.c.					
	1551	Distilling, rectifying, and blending of spirits; ethyl alcohol production from fermented materials					
	1554	Manufacture of soft drinks; production of mineral waters					
	2412	Manufacture of fertilizers and nitrogen compounds	ISIC 24: Chemicals (fertilizer only) Sub-sectors: 2412	Fertilizer	N/A	Low-tech manufactures Chemical products (fertilizer)	N/A
Petrochemicals	2310	Manufacture of coke oven products	ISIC 23: Coke and refined petroleum Sub-sectors: 2310, 2320	N/A	N/A	N/A	N/A
	2320	Manufacture of refined petroleum products					
Logistics and transportation	3410	Manufacture of motor vehicles	ISIC 34: Motor vehicles, trailers, semi-trailers ISIC 35: Other transport equipment Sub-sectors: 3410, 3420, 3430, 3511, 3512, 3520, 3530, 3591, 3592, 3599	N/A	Aviation Logistics and transportation	N/A	N/A
	3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers					
	3430	Manufacture of parts and accessories for motor vehicles and their engines					
	3511	Building and repairing of ships					

	3512 Building and repairing of pleasure and sporting boats 3520 Manufacture of railway and tramway locomotives and rolling stock 3530 Manufacture of aircraft and spacecraft 3591 Manufacture of motorcycles 3592 Manufacture of bicycles and invalid carriages 3599 Manufacture of other transport equipment n.e.c.					
Other clusters (incl. non-manufacturing-related activities)		N/A	N/A	Tourism knowledge-based services Creative arts	Commodities and services Tourism	N/A
					Processing and value addition High-end tourism Diversified tourism	N/A
					Medium- to high-tech manufactures ICT and other high-tech industries	N/A

Note: The green rows represent industries identified by UNIDO's Industrial Diagnostic, which are confirmed by at least one of Rwanda's national strategies; the orange rows represent otherwise.

National Strategy for Transformation (NST1). All of Rwanda's national strategies will be implemented by NST1, which has included the United Nations Sustainable Development Goals (SDGs) across a range of economic, social and environmental issues. NST1 is built on three pillars: 1) economic transformation; 2) social transformation, and 3) transformational governance. It highlights strategic development in (i) value addition and processing of mining products; (ii) textiles, garment and leather; (iii) meat, dairy and horticulture; (iv) aviation, logistics and transportation, and (v) tourism and knowledge-based services and creative arts. With the exception of the petrochemical and paper industries identified by UNIDO's Industrial Diagnostic, all other manufacturing industries identified, namely non-metallic minerals and basic metals, textiles, wearing apparel, leather, food and beverages, motor vehicles, and other transport equipment (see Column 1, Table 17) have been included in NST1 (see Column 3, Table 17).

National Industrial Policy (NIP). The objectives of Rwanda's NIP are stipulated in Vision 2020 and the Economic Development and Poverty Reduction Strategy 2008–12 (EDPRS). They include promoting economic growth with the target of becoming a middle-income country by 2020, which means achieving an average annual GDP growth rate of at least 8 per cent. NIP also envisages structural transformation, with industry accounting for 26 per cent of GDP by 2020; a national investment rate of 30 per cent of GDP; and non-farm employment reaching 1.4 million. NIP has selected ten clusters (across four progressive stages) that Rwanda will focus on in the short- to long term to promote value addition in existing industries and the emergence of new export industries (see Column 4, Table 17). The priority industries identified by UNIDO's Industrial Diagnostic are consistent with those included in NIP, except for coke and refined petroleum, motor vehicles, and other transport equipment.

Domestic Market Recapturing Strategy (DMRS). DMRS was developed by the Rwandan government to contribute to Vision 2020's objective of setting Rwanda on a path towards economic transformation from a subsistence agricultural economy to a knowledge-based society. DMRS's goals correspond with Rwanda's Vision 2020 and are closely aligned with NIP. DMRS aims to increase domestic production for local consumption while contributing to the structural transformation of the productive sector; to enhance international competitiveness and reduce the country's trade deficit. The strategy introduces a set of criteria, including the potential of forex saving, recapturing potential and existing investment projects, to identify 21 manufacturing sub-sectors (see Column 2, Table 17). When comparing the priority industries identified by UNIDO's Industrial Diagnostic (see Column 1, Table 17) and those selected by DMRS (see Column 2, Table 17), the strategic importance of construction materials, light manufacturing and agro-processing clusters is highlighted in both documents, excluding petrochemicals, logistics and transportation .

National Industrial Research and Development Agency (NIRDA) value chains. NIRDA identifies six value chains, namely (i) garments, (ii) wood processing and bamboo, (iii) banana wines, (iv) poultry, (v) fruits and vegetables, and (vi) animal feed. Apart from wood processing and bamboo, the manufacturing industries identified by UNIDO's Industrial Diagnostic, such as food and beverages, textiles, wearing apparel and leather, correspond with five of the value chains selected by NIRDA.

Table 17 reveals that Rwanda has developed a series of well-integrated national strategies for its Vision 2020–50 and programmes that are based on its strengths and potential opportunities. Rwanda's Vision 2020–50 is aspirational. Aside from being ambitious, the strategies presented are also achievable. They indicate a clear understanding of the weaknesses and obstacles Rwanda faces and how to effectively address them. A national strategy must also include the capacities to adapt to changing conditions. The Rwandan government could consider upgrading its capacities by cooperating with international agencies for technical assistance and technology transfer programmes for its priority industries.

Rwanda's manufacturing sector has been building on the agricultural sector, shifting towards agro-processing activities, and diversifying into light and export-oriented manufacturing activities. New industries and industrial segments (such as agro-processing chemicals) need to evolve to complement Rwanda's agricultural commodities. These industries will need to follow a different path of accumulation, which will depend far less on agro-processing and light manufacturing and much more on complex industrial structures and consumer demand at both the local and international levels.

Rwanda should continue exploiting its comparative advantage, i.e., its young and motivated labour force, and to continue upgrading its industrial structure, which will have to continue providing the necessary financial resources in the foreseeable future for other industries to flourish.

V. Manufacturing Sub-sector Prioritization for Rwanda

Following the prioritization of manufacturing industries based on six indicators and a preliminary desk-based verification of Rwanda's national strategies, we now focus on a more in-depth prioritization (second stage ranking) of manufacturing sub-sectors within each of the shortlisted industries.

The second stage ranking follows the same procedure as that used in the first ranking exercise. For an industry with at least three sub-sectors, such as the food and beverages industry, we start by identifying the top two performers (sub-sectors at the ISIC4 rev.3 level) for each indicator. We identify the top performers for industries with three or fewer sub-sectors, such as the paper industry.

In the second stage ranking, presented in Table 18, we identify 57 manufacturing sub-sectors. We highlight the top performers in each indicator using the same colour code. For example, in the chemical industry, the chemical sub-sectors (i) Manufacture of pesticides and other agrochemical products, and (ii) Manufacture of soap and detergents, cleaning and polishing preparations, perfumes, and toilet preparations, have the highest RCA. Furthermore, the (iii) Manufacture of fertilizers and nitrogen compounds, (iv) Manufacture of pharmaceuticals, medicinal chemicals and botanical products have the highest share of imports, and thus show strong potential for import substitution.

We revisit the desk-based verification exercise and find that the majority of sub-sectors identified in the second stage ranking correspond with the set of priority industries, value chains and products identified by Rwanda's government, with the exception of coke and refined petroleum.

The results of the two stages of prioritization serve different purposes: the results of the first stage ranking are useful for strategic alignment purposes and to facilitate consultations and discussions with counterparts due to the results' synthesis. The findings of the second stage ranking are useful for developing targeted and thematic enabler programmes (such as the innovator programme managed by NIRDA), as it provides more granular insights into the characteristics and scope of economic activities.

Although we cover the majority of components of industrial development in industry prioritization, some of the prioritized sub-sectors might be removed from the priority list due to Rwanda's market and technological constraints, for example, the manufacture of railway and tramway locomotives, building and repairing of ships, aircraft and spacecraft. The manufacture of other industries such as paper, automotive, and transport equipment industries may not be operational in the PCP to further limit the field of action and to pose the basis for an effective programme document formulation. On the other hand, other industries might be added based on national trends and emerging visions in consultation with the Rwandan government in the PCP formulation phase.

Table 18: Priority manufacturing sub-sectors in Rwanda

Rwanda									World
			Revealed comparative advantage (highest value)	Emerging comparative advantage (RCA between 0.3 and 0.9 with the highest growth rate)	Job creation potential (highest value)	Latent potential (Strong Latent potential with the highest growth rate of gross export)		Import substitution (highest value)	Word import dynamism (highest value)
ISIC 2 rev.3	ISIC 4 rev.3	Description	Revealed comparative advantages, RCA (2019)	RCA growth rate (2015-19)	Employment to population ratio (%)	Latent potential	Growth rate of gross export (2005-17)	Import (US$) 2019	World import growth rate (2010-19)
Food and beverages									
15	1512	Processing and preserving of fish and fish products				below	0.03		
15	1513	Processing and preserving of fruit and vegetables	0.3129	10.43%					
15	1514	Manufacture of vegetable and animal oils and fats						115,000,000	
15	1520	Manufacture of dairy products			0.0140%				
15	1531	Manufacture of grain mill products	21.8059						
15	1533	Manufacture of prepared animal feeds							4.38%
15	1541	Manufacture of bakery products							4.59%
15	1542	Manufacture of sugar	18.3385						
15	1543	Manufacture of cocoa, chocolate and sugar confectionery				below	0.81		
15	1549	Manufacture of other food products n.e.c.						35,800,000	
15	1551	Distilling, rectifying and blending of spirits; ethyl alcohol production from fermented materials	0.3897	161.34%					
15	1554	Manufacture of soft drinks; production of mineral waters			0.0223%				
Textiles									
17	1711	Preparation and spinning of textile fibres; weaving of textiles						30,100,000	
17	1721	Manufacture of made-up textile articles, except apparel	0.5129						
17	1722	Manufacture of carpets and rugs							0.99%
17	1723	Manufacture of cordage, rope, twine and netting							3.61%
17	1729	Manufacture of other textiles n.e.c.						5,232,496	
17	1730	Manufacture of knitted and crocheted fabrics and articles	0.3734						
Wearing apparel, fur									
18	1810	Manufacture of wearing apparel, except fur apparel	0.3242						
18	1820	Dressing and dyeing of fur; manufacture of articles of fur			0.0017%				
Leather, leather products and footwear									
19	1911	Tanning and dressing of leather						722,900	
19	1912	Manufacture of luggage, handbags and the like, saddlery and harness	1.1177						
19	1920	Manufacture of footwear							3.02%
Paper									
21	2101	Manufacture of pulp, paper and paperboard						30,300,000	
21	2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard							2.65%
21	2109	Manufacture of other articles of paper and paperboard	0.5144						
Coke and refined petroleum									
23	2310	Manufacture of coke oven products			0.0070%				
23	2320	Manufacture of refined petroleum products	1.1478						
Chemicals									
24	2411	Manufacture of basic chemicals, except fertilizers and nitrogen compounds				below	0.22		
24	2412	Manufacture of fertilizers and nitrogen compounds						51,600,000	
24	2413	Manufacture of plastics in primary forms and of synthetic rubber			0.0026%				
24	2421	Manufacture of pesticides and other agro-chemical products	0.5511						
24	2422	Manufacture of paints, varnishes and similar coatings, printing ink and mastics							0.35%
24	2423	Manufacture of pharmaceuticals, medicinal chemicals and botanical products						109,000,000	
24	2424	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet prepara	0.2075						
24	2429	Manufacture of other chemical products n.e.c.							0.42%
24	2430	Manufacture of man-made fibres				below	0.46		
Non-metallic minerals									
26	2610	Manufacture of glass and glass products	0.6021						
26	2691	Manufacture of non-structural non-refractory ceramic ware				below	0.09		
26	2692	Manufacture of refractory ceramic products						28,200,000	
26	2693	Manufacture of structural non-refractory clay and ceramic products				below	0.77		
26	2694	Manufacture of cement, lime and plaster	17.8085						
26	2695	Manufacture of articles of concrete, cement and plaster							4.90%
26	2696	Cutting, shaping and finishing of stone			0.0049%				
26	2699	Manufacture of other non-metallic mineral products n.e.c.						13,600,000	
Basic metals									
27	2710	Manufacture of basic iron and steel	0.5117	45.60%					
27	2720	Manufacture of basic precious and non-ferrous metals	4.1008						

Motor vehicles, trailers, semi-trailers									
34	3410	Manufacture of motor vehicles	0.4048						
34	3420	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers							5.25%
34	3430	Manufacture of parts and accessories for motor vehicles and their engines						21,500,000	
Other transport equipment									
35	3511	Building and repairing of ships			0.0055%				
35	3512	Building and repairing of pleasure and sporting boats							2.67%
35	3520	Manufacture of railway and tramway locomotives and rolling stock			0.0028%				
35	3530	Manufacture of aircraft and spacecraft						6,739,830	
35	3591	Manufacture of motorcycles	0.3768						
35	3592	Manufacture of bicycles and invalid carriages						5,627,590	
35	3599	Manufacture of other transport equipment n.e.c.							4.09%

Source: UNIDO elaboration based on various sources.

Note: Strong latent potential indicates that Rwanda's actual export performance lies below the average performance of lower middle-income comparators. The opposite is the case for weak latent potential. Growth rate represents the cumulative annual growth rate (CAGR) of the period.

SECTION 3: IDENTIFICATION OF KEY BOTTLENECKS FOR RWANDA

VI. Introduction

This section of the report discusses the key bottlenecks that firms in Rwanda face in their daily operations. Specifically, it focuses on formal manufacturing firms. As manufacturing is a priority sector for Rwanda alongside the development of high-end services as outlined in the country's Vision 2020 and the Ministry of Trade and Industry's Industrial Master Plan for 2009–2020 and National Industrial Policy in 2011 (Chang et al., 2016), this section contributes to understanding the key bottlenecks that prevent the country's manufacturing firms from attaining the identified industrial targets.

Bottlenecks in this context are defined as problems related to factors that have a negative impact on the performance of manufacturing firms and their ability to create value added and jobs. The bottlenecks range from problems related to direct inputs such as capital, labour and other production inputs, or indirect inputs such as the institutional frameworks for labour regulation, customs and trade regulation, tax rates, business licensing, finance, land rights, independent courts, political instability, amongst others.

The manufacturing sector needs efficient "network" services, cargo transport, transportation insurance, finance and business service systems for transfers between buyers and sellers, legal consultation services to deal with licenses, patents and franchise issues; the availability of human capital for innovation, and a strong institutional regime that guarantees property rights, contract enforcement and to boost investor confidence. Additionally, the manufacturing sector needs an efficient telecommunication system that makes it easy for firms to effectively coordinate with clients and suppliers and to help downstream manufacturing firms manage their supply chains (Aker & Mbiti, 2010). In terms of electricity, adequate and uninterrupted power supply ensures production lines can operate continuously and that production assets are not left to lie idle. A combination of these direct and indirect inputs goes a long way to affect the performance of downstream manufacturing firms. The absence or inefficient supply of these inputs makes manufacturing firms non-competitive (Arnold et. al., 2008; Arnold et. al., 2011; Arnold et al., 2016).

Although Rwanda's industrial policy and accompanying strategic documents list key objectives and intervention areas, this section aims to substantiate and quantify the challenges manufacturing firms in the country face as well as highlight the emerging major bottlenecks for the priority focus areas. The analysis in this section is based on surveys conducted by the World Bank Group in their series of Enterprise Surveys (WBES). In Rwanda, the WBES dates back to 2006. Data for the recently released WBES 2019/2020 are included here. In total, we use three waves of the WBES for the years 2006, 2011 and 2019/2020 to observe the overall trends and development of bottlenecks Rwanda's

manufacturing firms have faced over the last 13 to 14 years. The latest available wave from the WBES database is used for the comparator countries. Details on the databases used for this analysis are provided in Appendix III. A careful and thorough analysis of the survey data resulted in the identification of 17 overall factors. Each of these 17 factors represents a potential bottleneck Rwandan firms have faced in their daily operations. We identify the severity of these bottlenecks by summing up the share of manufacturing firms in Rwanda that responded that at least one of the 17 factors represented a "very severe or major bottleneck" to their operations. Given the PCP's mandate to prioritize industrialization, we rank and compare these potential obstacles at the level of manufacturing sector firms in Rwanda. We compare how the potential bottlenecks in the manufacturing sector differ across locations (Kigali, Southern province, and Western province); across firm size (large and small- and medium-sized enterprises (SMEs))[53], ownership structure (foreign and domestic enterprises[54]), and across exporting and non-exporting firms[55]. We additionally document how these factors are ranked by manufacturing firms compared to the average of non-manufacturing firms in Rwanda and the average comparator manufacturing firms in other SSA countries (this group is referred to the manufacturing benchmark group).

The next section of the report provides an overview of the characteristics of manufacturing firms in Rwanda. Next, the findings on key bottlenecks in general are summarized, highlighting the major bottlenecks for priority policy intervention. In the fourth section, we delve deeper to provide details on the major bottlenecks and highlight other selected bottlenecks. It is important to mention that the bottlenecks identified and detailed in this report have also been discussed with relevant stakeholders during consultations.

VII. Profile of Manufacturing Firms in Rwanda

Manufacturing firms in Rwanda are predominantly small (78 per cent) and domestically owned (82 per cent). Over 79 per cent of Rwandan manufacturing firms have been in operation for five years or longer. Additionally, goods-producing firms in Rwanda are non-exporters, active domestically but with remarkably limited engagement in global trade. Around 35 per cent of manufacturing firms are exporters, consisting of large (77 per cent) and foreign-owned firms (68.1 per cent).[56] Although the total number of exporting manufacturing firms in the country remains low, there has been a surge in

[53] As defined in the WBES dataset, small and medium sized enterprises are all enterprises with (5-99) workers and large sized enterprises are those with (100 and over) workers.

[54] Foreign ownership/enterprise is a dummy equal to one if there is any foreign ownership in the establishment and zero if otherwise. Domestic ownership/enterprise on the other hand is a dummy equal to one if there is no foreign ownership in the establishment.

[55] Exporting firm is a dummy equal to one if a firm engages in either direct or indirect export of goods or both and zero if otherwise. Non-exporting firms on the other hand is a dummy equal to one if a firm does not engage in either direct or indirect export of goods or both.

[56] This is based on calculations using the 2019/2020 World Bank Enterprise Survey for Rwanda. Similar trends are also documented in Frazer and Van Biesebroeck (2019).

the total number of exporting firms in the country, increasing from 22 per cent in 2006[57] to 27.1 per cent in 2011[58] and 35 per cent in 2019.

As documented in Frazer and Van Biesebroeck (2019), the productivity of these exporting firms is also high. Average sales per worker are USD 45,000 for the marginal exporting manufacturing firm and about 158,000 USD for the largest exporters. Very importantly, the sector's contribution to the country's total exports rose from 6 per cent to 21 per cent between 2008 and 2016. Large manufacturing firms, on average, employed 519 workers in 2019, representing an increase of about 20 per cent from 2011. SMEs, on the other hand, employed around 25 workers.[59]

Despite the impressive growth in the share of exporting manufacturing firms in the country, albeit from a lower base, the majority of manufacturing output produced in Rwanda is consumed domestically and the little that is exported is extremely concentrated in terms of trade destinations and is almost exclusively delivered to a few neighbouring countries such as Burundi and the Democratic Republic of Congo. This trend has not decreased over time (Frazer and Van Biesebroeck, 2019). In terms of inputs, manufacturing firms in Rwanda source a significant share of intermediate inputs and value-added from within (about 81 per cent),[60] and rely very little on imported intermediates (Van Biesebroeck and Mensah, 2019).

VIII. Main Obstacles for Manufacturing Firms

Table 19 presents three periods (2006, 2011 and 2019), the share of formal manufacturing firms in Rwanda, and its comparator group that listed the 17 factors as being 'very severe or major' obstacles to their business operations. Overall, Rwanda's performance is better in relative terms than other SSA comparator countries (see the complete list of countries in Table A.III.2 in the Appendix) with reference to these bottlenecks, and the number of firms reporting these bottlenecks as being a very severe or major obstacle to their operations have declined over time. Although the severity of these obstacles to business operations is comparably lower in Rwanda than in other SSA countries, some relevant problems still exist.

In 2006, Rwandan manufacturing firms perceived access to electricity (74.6 per cent), tax rates (49.2 per cent), transportation (40.7 per cent), access to finance (40.7 per cent) and tax administration (25.4 per cent) as the top five bottlenecks to their operations. In 2019, however, the share of manufacturing firms that perceived these factors as major business obstacles dropped substantially to 8.3 per cent for access to electricity, 10.8 per cent for tax rates, 3.3 per cent for transportation, 15.8 per cent for access to finance and 3.3 per cent for tax administration.

Despite these remarkable drops, three (access to finance, tax rate, and electricity) out of these five factors, together with competition from the informal sector (13.3 per cent) and inadequately skilled labour force (7.5 per cent) emerged in 2019 as the most widely perceived major business obstacles by

[57] This is based on calculations using the 2006 World Bank Enterprise Survey for Rwanda.
[58] This is based on calculations using the 2011 World Bank Enterprise Survey for Rwanda.
[59] This is based on calculations using 2019/2020 and 2011 World Bank Enterprise Survey for Rwanda.
[60] This is based on calculations using 2019/2020 and 2011 World Bank Enterprise Survey for Rwanda.

formal manufacturing firms in the country. Domestically-owned firms[61], small-and medium-sized enterprises, non-exporting manufacturing firms and manufacturing firms located in the Southern and Western provinces[62] of Rwanda appeared to have been more strongly affected by these obstacles. There are a few exceptions to this general observation. For instance, more exporting manufacturing firms perceived access to electricity as being a very severe and major obstacle to their business operations. These firms seem less confident about the country's electricity situation and nearly 58 per cent of these firms therefore either own or share a generator (see Table 25 on electricity).[63] Similarly, more exporting than non-exporting firms reported access to finance to be a major obstacle to their business operations.

Compared to other countries in SSA, however, the share of manufacturing firms in Rwanda that perceived each individual factor to be a major business obstacle is markedly lower than the average share of SSA manufacturing firms, as reported in Table 19. For instance, the share of formal manufacturing firms in Rwanda that perceived access to finance as a major obstacle was around 19.5 percentage points lower than the average share of SSA manufacturing firms. Similarly, the share of manufacturing firms in Rwanda that perceived access to electricity to be a major obstacle was 41.8 per cent lower than the average share of manufacturing firms in SSA. Similar differences in Rwanda's favour also emerge when the share of manufacturing firms that perceived the informal sector or the inadequately skilled labour force to be major business obstacles are compared to the corresponding average shares of SSA manufacturing firms (see Table 19). Aside from the five major obstacles discussed above, other factors listed in Table 19 also indicate a downward trend in the shares of manufacturing firms that reported these factors to pose a very severe and major obstacle to their business operations between 2006 and 2019.

[61] Tables of Section 3 contain information of domestic owned firms, small and medium enterprises, non-exporting firms and firms in different regions for the manufacturing sector. In the Appendix of Section 3, sub – section d) results for groups of firms are contained for the overall economy.

[62] There are few exceptions. A greater share of firms in Kigali than in the Western province perceived tax rates to be a major bottleneck to their business operations. Similarly, a greater share of firms in Kigali than in the Southern province perceived access to finance and inadequately skilled labour as a major bottleneck to their business operations.

[63] This could also mean that these firms have the financial capacity to own or share a generator.

Table 19: Share of firms identifying the listed factors as very severe or major bottlenecks to their business operations

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Electricity	74.6 22.2 8.3	7.9	50.1	6.7	5.1	13.8	9.2	0	3.8	9.5	11.6	6.4
Telecom.	15.3 13.6 .	.	15.4	.	.	.	.	.	.	.	.	.
Transportation	40.7 30.9 3.3	2.9	21.4	0	5.1	5.5	3.7	0	0	4.3	2.3	3.9
Customs	22.0 14.8 0.8	3.3	18.6	2.2	0	0	0.9	0	0	1.0	0	1.3
Informal sector	23.7 48.2 13.3	10.0	32.3	15.5	10.2	13.8	14.7	4.5	3.8	15.9	4.6	18.2
Access to land	22.0 16.1 4.2	8.8	26.5	2.2	5.1	5.5	3.6	0	0	5.3	6.9	2.6
Courts	15.3 6.2 0	0.4	11.3	0	0	0	0	0	0	0	0	0
Crime	11.9 13.6 3.3	5.0	18.3	0	7.6	2.7	3.7	4.5	3.8	3.2	2.3	3.9
Tax rates	49.2 14.8 10.8	9.5	28.6	6.6	18.0	8.3	11.0	4.5	3.8	12.8	0	16.8
Tax admin.	25.4 18.5 3.3	3.3	23.1	4.4	2.6	2.7	2.7	4.5	7.7	2.1	4.6	2.6
Business lic. and permits	6.8 6.2 0.8	0	14.5	0	0	2.7	0.9	0	0	1.0	0	1.3
Macroeconomic stability	25.4 . .	.	80.0	.	.	.	.	.	.	.	.	.
Political instability	8.5 18.5 0	0.4	25.7	0	0	0	0	0	0	0	0	0
Corruption	20.3 13.6 1.7	0	32.6	0	5.2	0	1.8	0	0	2.2	0	2.6
Access to finance	40.7 33.3 15.8	14.5	35.3	6.6	10.2	33.3	16.5	4.5	3.5	19.1	18.5	14.2
Labour regulation	13.6 9.9 2.5	1.8	10.1	2.2	5.1	0	2.7	0	0	3.1	4.6	1.3
Inadequately skilled labour force	13.6 29.6 7.5	3.8	16.1	4.4	5.1	13.8	7.3	4.5	3.8	8.5	4.6	9.1

Note: '.' means data is not available for the indicator for the reference year. It also means that data is not available for the industry and location for the particular indicator. A value of 0 means that no establishment or industry identify the indicator as a very severe or major bottleneck to their operations. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

IX. Bottlenecks in Detail

a) Access to finance

Existing empirical evidence suggests that access to finance increases firm productivity, employment creation and participation in international trade, which ultimately leads to economic growth and poverty reduction (Rahaman, 2011; Manova, 2013; Fowowe, 2017; Arnold et. al., 2008). This occurs because access to finance enables firms to expand their operations, innovate and invest in production facilities, including investing in a skilled workforce (OECD, 2006b). Therefore, well-functioning and developed financial markets become of utmost policy importance because it ensures efficient allocation of scarce financial resources to firms to finance productive investments. This section discusses the situation of manufacturing firms in Rwanda regarding access to finance.

According to the Enterprise Survey, and as shown in Table 20, over 70 per cent of manufacturing firms in Rwanda source their working capital from retained earnings or through internal funds. This is regardless of firm location, ownership, firm size, and whether a firm is an exporter or non-exporter. This is relatively higher than the average share of manufacturing firms in SSA (69.5 per cent) that use retained earnings as a source of working capital. Banks in Rwanda provide 13.3 per cent of manufacturing firms' working capital, a figure that is 4 per cent higher than the SSA average. Financial assistance from suppliers and customers represents a very important source, contributing close to 5 per cent of the working capital of manufacturing firms in the country.

Table 20: Source of working capital 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% from retained earnings	76.3	78.5	69.5	82.3	74.3	71.3	75.5	88.9	84.7	74.2	78.3	75.1
% from banks	13.3	14.7	9.3	14.6	11.5	13.7	13.2	9.9	13.5	13.2	16.2	11.7
% from non-bank financial institutions	3.6	1.8	1.9	0.5	3.8	7.2	4.0	0.4	0.4	4.6	0.8	5.2
% from suppliers/customers	4.9	2.9	8.2	1.6	7.9	5.5	5.2	0.4	1.1	6.0	1.6	7.0
% from friends and relatives	1.6	1.9	5.5	0.7	2.2	2.1	1.8	0.2	0.2	2.0	3.4	0.7

Note: Sources of raising working capital (%) 2019. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Except for manufacturing firms in the Southern province (79.4 per cent), over 80 per cent of manufacturing firms in the country has a savings or checking account (Table 21). This is regardless of firm ownership, firm size, and whether a firm is an exporter or non-exporter and is higher than the average share of bankable manufacturing firms in SSA (84 per cent). Thirty percent of these bankable

firms in Rwanda have an overdraft facility (1.7 lower than the SSA average share) and 32.5 per cent have a line of credit (11.4 per cent higher than the SSA average share). From the foregoing, it is fair to say that manufacturing firms in Rwanda have more access to finance than manufacturing firms in comparator SSA countries.

Table 21: Financing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% firms with checking or savings account	92.5	94.1	84.0	100.0	79.4	97.2	91.7	100.0	100.0	90.4	100.0	88.3
% firms with overdraft facility	30.0	28.3	31.7	57.7	7.6	19.4	25.6	63.4	61.5	21.2	53.4	16.8
% firms with line of credit or loan	32.5	34.1	21.1	35.5	23.1	38.8	32.1	40.9	46.1	28.7	44.1	25.9

Note: Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey 2019.

The average number of times firms applied for a new loan/line of credit (1.3) and the average number of times the applications were rejected (0.2 equivalent to 15 per cent of applications) (Table 22) further support the lower share of manufacturing firms in Rwanda (40.7 per cent in 2006 to 8.3 per cent in 2019) (Table 19) that perceived access to finance as a major business obstacle relative to the average share of manufacturing firms in SSA. This is also consistent with the World Bank Ease of Doing Business report that ranks the country in the first position in SSA in terms of getting credit (World Bank Doing Business, 2019).

Table 22: Outcome of loan application 2006

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
No. of applications	1.3	1.8	1.5	.	.	.	1.2	1.7	1.4	0.4	1.2	0.3
No. of rejected applications	0.2	0.5	0.7	.	.	.	0.2	0.3	0.0	0.3	0.2	0.2

Note: Average number of times a firm applied for a new loan or line of credit and average number of times of rejection of financial applications. '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Mnf: Manufacturing. Rwanda 2006 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Despite the remarkable success achieved in terms of access to finance, among the top five factors ranked by Rwandan firms as major business obstacles in 2019, access to finance was ranked first (see Table 19) suggesting the need for more concerted policy efforts to address the associated market and

institutional failures in the country's finance sector. According to the PSDYE (2017), firms in Rwanda, like other SSA countries, struggle to mobilize financing for their operations. This is evident across all industries and firm sizes, except for very large firms that are relatively able to mobilize financing for their operations. This is also consistent with Table 19, which shows that fewer large and foreign firms perceived access to finance as a major obstacle to their business operations. One-third of firms in the country struggle to operate their facilities at full capacity due to working capital constraints. Also, more than 40 per cent of firms reported that access to affordable finance was the number one constraint to private sector development in Rwanda (PSDYE, 2017). While part of this problem is attributed to the low capacity of Rwandan firms to design bankable projects, there is also a narrow range of finance availability and specific challenges within the financial sector that make it difficult for firms to access finance for their operations. For instance, firms that want to export need to obtain letters of credit which can be challenging to obtain. Receiving international payments cost as much as 5 per cent to 20 per cent in fees and currency exchange losses (PSDYE, 2017).

As reported in Table 23, while 37.6 per cent of manufacturing firms had not applied for a loan because they did not need one, the rest indicated factors such as the complex application procedure (14.6 per cent), unfavourable interest rates (9.4 per cent), and high collateral requirements (7.3 per cent) as reasons for not applying for a loan. Important heterogeneities also arise across formal manufacturing firm types. Domestically-owned firms, SMEs, non-exporting manufacturing firms and manufacturing firms not located in Kigali appear to be more strongly affected by these obstacles. However, more foreign firms and exporting firms reported that the interest rates are not favourable.

Table 23: Access to finance: Reasons for not applying 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
No need for loan	37.5	42.0	44.8	47.1	34.2	29.6	35.9	64.2	77.8	28.2	50.0	30.6
Application procedure were too complex	14.6	13.0	11.2	11.7	14.2	18.5	15.7	7.1	11.1	15.4	8.8	17.7
Interest rates were not favourable	9.4	6.7	16.1	14.7	2.8	11.1	7.9	14.3	5.6	10.3	14.7	6.4
Collateral requirements were too high	7.3	7.3	10.3	2.9	8.5	11.1	7.9	0	0	8.9	2.9	9.6
Size of loan and maturity insufficient	4.2	3.6	1.6	2.9	5.7	3.7	3.4	0	0	5.1	2.9	4.8
Other	21.9	20.7	8.1	20.5	25.7	18.5	23.6	14.2	5.6	25.6	20.5	22.5

Note: Share (%) of firms that responded why they did not apply for a loan. 0 means that no establishment or industry identify the indicator as a very severe or major bottleneck to their operations. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Manufacturing firms in Rwanda that applied for a new loan or new line of credit were required to provide collateral with a value about three times the value of the loan or line of credit applied for. This is regardless of firm location, ownership, firm size, and whether a firm is an exporter or non-exporter. This situation seems to have deteriorated. In 2006, the collateral required for a loan was, on average, 166 per cent of the value of the loan or line of credit applied for as reported in Table 24.

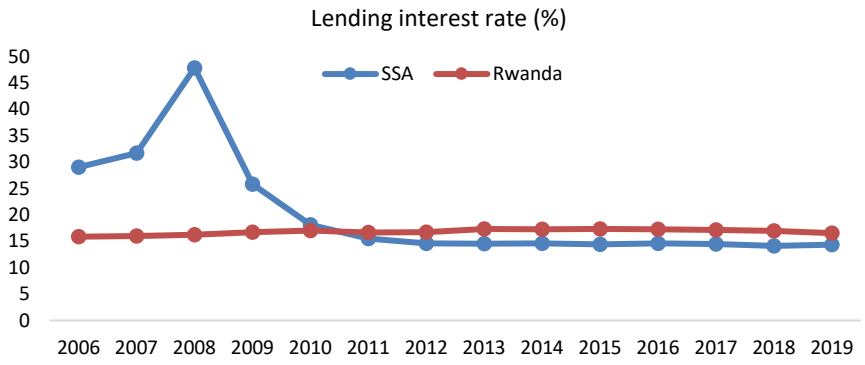
Table 24: Required collateral as a share of the total value of loan/line of credit

	Mnf 2006 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Collateral needed in % of total value of loan/line of credit	166.8 288.9	261.4	320.8	305.1	202.5	332.4	292.4	278.6	315.1	279.8	278.1	299.0

Note: Collateral as a share of total value of loan/line of credit. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

Consultations with stakeholders confirm the importance of access to finance for manufacturing firms in the country and despite efforts made to increase access to finance, it still remains a bottleneck to business operations. The stakeholders mentioned that the complex application procedure is not a major obstacle to access finance, at least from their experience and engagement with firms. They agree, however, that high interest rates, high collateral costs, improper financial bookkeeping (especially for firms not paying VAT), and lack of information about potential opportunities that exist in the financial market, act as barriers to access to finance. For instance, the Rwandan financial sector is dominated by commercial banks, all of which require a more than 100 per cent finance value in collateral, with a prime interest rate that remains high at between 16 per cent and 18 per cent (PSDYE, 2017). Lending interest rates in Rwanda are also higher than the SSA average (Figure 31).

Figure 31: Lending interest rates



Source: World Bank WDI.

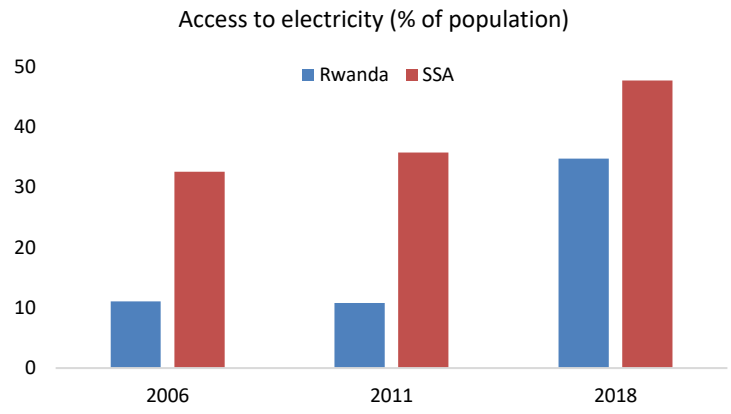
The stakeholders also mentioned that the government has put measures in place to help alleviate these constraints. For instance, some institutions in the country have been contracted to guide firms

on how to keep proper books of accounts and how to successfully prepare and present projects to banks for financial support. Also, the government has set up an agency called Business Development Fund that acts as a guarantor for firms seeking to apply for financial support from banks but lack the required collateral to secure new loans or lines of credit.

b) Bottleneck: Electricity

Adequate power supply ensures that production lines remain uninterrupted and production assets are not left to lie idle. For this reason, unreliable electrical power supply increases the production and operational costs of firms and serves as a disincentive to investors, leading to the diversion of foreign investment. All of these factors put together makes firms non-competitive (Arnold et al., 2008; Andersen and Dalgard, 2013). Abeberese (2013), for instance, shows firms that are located in countries with poor power supply, lack the incentive to either move to productivity-enhancing industries or expand, since doing so comes at the high cost of having to rely on electricity. Cole et al. (2018) find that reducing average power outage levels to those of South Africa would increase the overall sales of firms in sub-Saharan Africa by 85.1 per cent. Abdisa (2018) also finds that power outages in Ethiopia negatively affect firms' productivity, increasing firms' costs by 15 per cent from 2011 to 2015, with the negative effect being higher for smaller firms.

Figure 32: Share of population with access to electricity



Source: World Bank WDI.

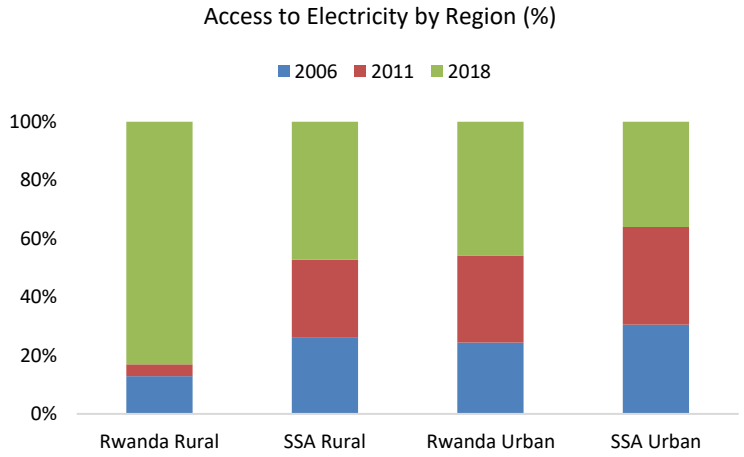
Given the banes associated with poor electrical power supply on the economy and the prospect of transitioning from a low-income to a middle-income country, the Government of Rwanda is aiming at 100 per cent electricity access by 2024. The country currently only has 218 MW of installed generation capacity, with the major electricity sources being hydroelectric (42 per cent), thermal (31 per cent), methane (14 per cent) and solar (5 per cent).[64] To date, 59.7 per cent of Rwandan households have access to electricity, and are either connected to the national grid (43.8 per cent) or obtain their

[64] http://reg.rw/what-we-do/access/ 14/09/2020.

electricity from off-grid systems (15.9 per cent).[65] As shown in Figure 32 and Figure 33, access to electricity in Rwanda, including in rural and urban areas, has increased substantially over time.

In 2006, only about 4 per cent of the rural population had access to electricity. By 2018, nearly 24 per cent of the same population had access to electricity (Figure 32). Access to electricity in Rwanda's urban areas is substantially higher. About 89 per cent of the urban population had access to electricity in 2018. Between 2006 and 2018, the share of urban population with access to electricity increased by almost 42 per cent (Figure 33). Compared to the average SSA sample, however, access to electricity in Rwanda is lower, although the country performs better than the average SSA country in terms of the electricity access rate in urban areas as presented in Figure 32 and Figure 33.

Figure 33: Share of rural and urban population with access to electricity



Source: World Bank WDI.

Consistent with the general improvements in access to electricity in the country, the share of Rwandan manufacturing firms that perceived access to electricity as a major business obstacle declined by 66.3 percentage points between 2006 and 2019 (Table 19). Compared to 2006, when 74.6 per cent of manufacturing firms perceived access to electricity to be a major obstacle to business operations, only 8.3 per cent of firms perceived it as a major obstacle to business operations in 2019. Also, compared to the 50.1 per cent average share of manufacturing firms in SSA that perceived access to electricity to be a major obstacle in 2019, manufacturing firms in Rwanda are better off, as the country's share of manufacturing firms that perceived access to electricity as a major obstacle to their business operations was 41.8 percentage point lower than the SSA average. Nevertheless, there seem to be heterogeneities due to firm characteristics. In 2019 (Table 19), more exporting manufacturing firms (11.6 per cent) tended to perceive access to electricity to be an obstacle to their business operations, although this figure represents a significant drop in the number of firms claiming that access to electricity posed a problem in 2006. Specifically, about 63.2 per cent of exporting firms, respectively, perceived access to electricity to be a major obstacle in 2006. Despite the progress, these firms seemed

[65] http://reg.rw/what-we-do/access/ 19/03/2021.

to be less confident about the country's electricity situation and for that matter, nearly 58 per cent of these firms either own or share a generator (see Table 25).[66]

In terms of location, only 6.7 per cent of firms located in Kigali, the capital city, perceived access to electricity to be a major obstacle, while around 15.1 per cent and 13.8 per cent of firms located either in the Southern or Western provinces perceived access to electricity to be a major obstacle, indicating a significant spatial disparity in electricity access across the country. This is also consistent with the World Bank's data in Figure 33.

According to the Enterprise Survey, about 36.7 per cent of all manufacturing firms in Rwanda in 2019 reported experiencing a power outage in a typical month, occurring about eight times in a typical month, with each power outage lasting for about less than one hour. These power outages also cost firms 2 per cent of losses in sales. These figures represent a significant improvement in the country's electricity situation since 2006. In 2006, about 81.4 per cent of all manufacturing firms in Rwanda reported experiencing a power outage in a typical month, occurring about 15 times in a typical month, with each power outage lasting for about four hours and costing firms about 9.2 per cent losses in sales (Table 25). Compared to manufacturing firms in comparator SSA countries, for each of these indicators, the share of manufacturing firms that perceived them as major business obstacles was lower in Rwanda than in comparator countries in SSA. They were also lower than the share of non-manufacturing firms in the country. Specifically, there were fewer manufacturing firms in Rwanda than in SSA that experienced power outages in a typical month, there were also fewer occurrences of power outages in a typical month in Rwanda than in other SSA countries; power outages in other SSA countries lasted longer than in Rwanda before they were restored (Table 25). As expected, improvement in access to electricity in the country was followed by a 39.9 per cent reduction in the share of manufacturing firms that own or share generators between 2006 and 2019 (Table 25). This is also consistent with the World Bank's Ease of Doing Business report that ranks the country in the second position in SSA in terms of access to electricity (World Bank Doing Business, 2019).

Different stakeholders we spoke to supported these progressive trends in access to electricity in the country. They reported that load shedding has reduced, and power cuts have reduced significantly. They mentioned, however, that there is still room for improvement. Specifically, providing and extending access to electricity to the rural population is very important. The stakeholders also reported that high electricity costs in the country still represent a huge bottleneck to the operations of firms. According to the Enterprise Survey, firms spent 5.1 per cent of total production cost on electricity in 2019 (Table 25). The country's high electricity cost is also highlighted in the PSDYE (2017) report. The report reveals that the lack of affordable electricity is a challenge to firms' operations. This is particularly the case for larger firms engaged in the manufacturing and in high-end service sectors for whom high-quality connectivity is paramount. Firms also cite high energy costs as contributing to the high production costs. In 2016, manufacturing firms in Rwanda paid an average tariff of USD 0.24 per kWh — the most expensive tariff in East Africa. In comparison, Tanzania's industrial tariffs in 2016 averaged USD 0.12 while it was USD 0.13 in Uganda. The high-power tariffs in the country have partly

[66] This could also mean that these firms have the financial capacity to own or share a generator.

been blamed for the slow growth of the manufacturing sector. From our consultations it emerged that high energy costs have a negative impact on the profitability of businesses in Rwanda.[67]

Table 25: Electricity

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Experience power outages (%)	81.4 66.7 36.7	40.0	76.3	35.5	23.0	52.7	37.6	31.8	30.7	38.3	48.8	29.8
Number of power outages	15.1 5.4 7.7	11.1	17.6	5.1	11.0	8.3	8.1	3.5	3.6	8.6	4.6	10.5
Length of power outages	4.1 6.0 0.8	1.2	8.7	0.6	1.2	0.8	0.8	0.2	0.3	0.9	0.8	0.7
Losses (%) of sales	9.2 4.9 2.0	3.1	13.3	2.8	0.0	1.9	2.1	0.4	0.6	2.4	0.7	4.0
% that own or share generator	56.9 60.5 34.2	37.9	52.5	55.5	10.2	33.3	33.9	59.1	57.6	27.6	58.1	20.7
% of electricity from own or shared generator	30.3 7.6 9.6	7.6	35.1	8.3	14.6	9.4	9.9	10.2	9.0	9.9	8.3	11.7
Cost % of electricity[68]	8.5 13.5 5.1	6.7	14.3	2.7	6.4	6.5	5.2	5.3	4.9	5.2	3.2	6.1

Note: Mnf: Manufacturing. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

In January 2020, the Rwandan Utilities Regulatory Authority (RURA) announced new electricity tariffs. The new reviewed tariffs favoured healthcare facilities and data centres but were increased for industries and residential consumers. The tariff for healthcare facilities was revised from RWF 192 per kilowatt-hour (KWh) to RWF 186 per KWh, a reduction of 3 per cent. Residential customers who consume between 15 KWh and 50 KWh per month now pay RWF 212 per KWh instead of RWF 182, while those who consume beyond 50 KWh per month pay RWF 249 per KWh instead of RWF 210. Although given incentives (in the form of subsidies) depend on the time of operations (off-peak, shoulder hours, and peak hours), the government increased the tariffs for small industries (RWF 110 to RWF 134 per KWh), medium industries (RWF 87 to RWF 103 per KWh), and large industries (RWF 80 to RWF 94 per KWh). The new tariffs were last revised in 2018 but are now expected to be reviewed every quarter to cater for fluctuating costs, such as currency exchange rates and fuel costs. The

[67] Accessed at: https://www.theeastafrican.co.ke/tea/business/rwanda-s-power-costs-set-to-decline--1355742#:~:text=According%20to%20highly%20placed%20sources,%240.12%3B%20while%20Uganda's%20average%20%240.13. Accessed on 15/09/2020.

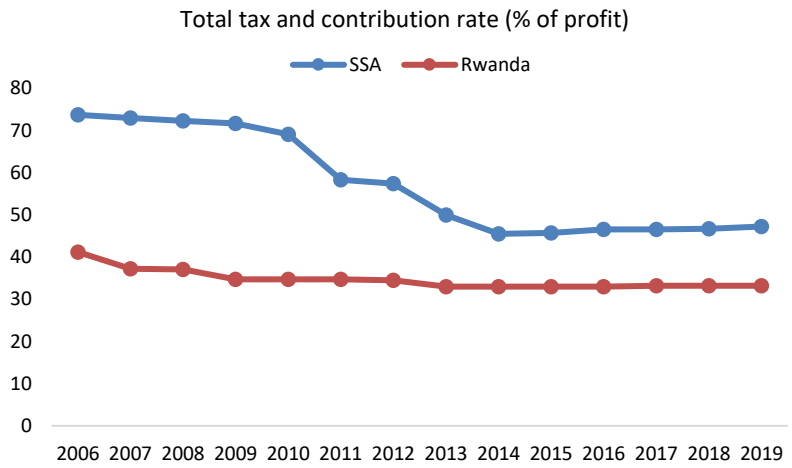
[68] Share of electricity cost to total cost (%).

increase in tariffs is even higher for industries without smart metres. Small, medium, and large industries without smart metres pay a flat rate of RWF 151 per KWh, RWF 123 per KWh, and RWF 106 per KWh, respectively. The increase in electricity tariffs is attributed to the increased production of electricity, as well as activities related to the expansion and maintenance of the network.[69]

c) Tax rates

Tax constitutes an essential component of a government's source of revenue, with large intended public goods and services provision being dependent on it. In this vein, there is a widespread view that higher tax compliance from citizens and corporate entities spurs economic growth and development by enabling the government to fulfil its social contract (Barro, 1990; Barro & Sala-i-Martin, 1992; Eubank, 2011; Gadenne, 2011; OECD, 2013). Nonetheless, when the tax burden becomes too high, it can reduce economic growth because it diverts away scarce resources from productive investments, such as innovation and capital investment. For instance, Liu & Mao (2019) find that a tax incentive programme for Chinese firms' investment in fixed assets between 2004 and 2009, on average, raised investments and productivity of the treated firms relative to the control firms by 38.4 per cent and 8.9 per cent, respectively. One of the ways tax burdens increase is through high tax rates.

Figure 34: Total tax and contribution rate (% of profit)[70]



Source: World Bank WDI.

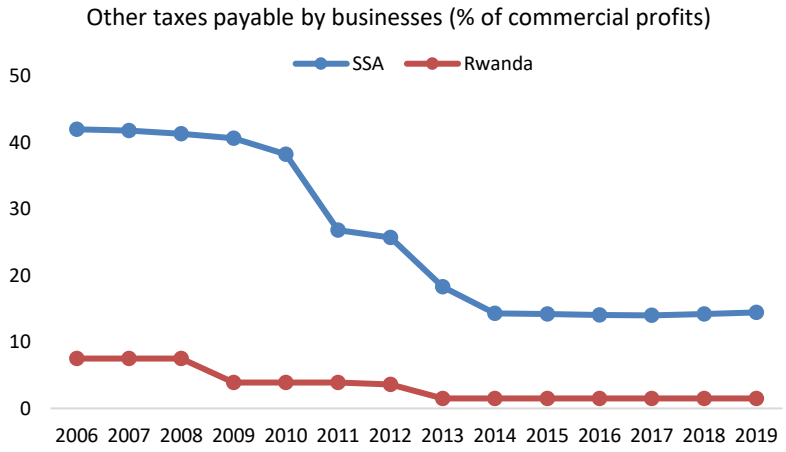
The tax rate is still among the top five bottlenecks manufacturing firms in Rwanda face. However, as shown in *Figure 34* and *Figure 35*, tax rates in Rwanda are business-friendly compared to the average tax rates in SSA. Specifically, between 2006 and 2019, the 'Total tax and contribution rate (% of profit)' declined by 8 per cent, while 'Other taxes payable by businesses (% of commercial profits)' declined by 6 per cent. Consistent with this drop at the aggregate level, the share of manufacturing firms that

[69] Accessed at: https://www.newtimes.co.rw/news/electricity-tariffs-increased-residential-consumers-industries#:~:text=Residential%20customers%20who%20consume%20between,per%20KWh%20instead%20of%20Rwf210. Accessed on 15/09/2020.

[70] The total tax rate measures the amount of taxes and mandatory contributions payable by businesses after accounting for allowable deductions and exemptions as a share of commercial profits. Taxes withheld (such as personal income tax) or collected and remitted to tax authorities (such as value added taxes, sales taxes or goods and service taxes) are excluded.

reported tax rates to be a major business obstacle dropped substantially from 49.2 per cent in 2006 to 10.8 per cent in 2019. Similar patterns emerge across all manufacturing firm types between 2006 and 2019, as shown in Table 19. Comparing firm types over time, the differences between domestic and foreign firms' shares that perceived tax rates as a major business obstacle tend to be time-dependent, although declining over time in both cases. However, the share of SMEs that perceived the tax rates as a major obstacle was consistently higher than the share of large formal manufacturing firms over time. The Enterprise Survey does not ask for details, however, this pattern could be an indicator of structural and institutional conditions in the tax system such as special tax incentive packages favouring large firms. More firms in the country's Southern province perceived tax rates as a major obstacle to their business operations. Compared to the average of other comparator African countries, tax rates are lower in Rwanda (*Figure 34* and *Figure 35*) and the share of manufacturing firms in the country that perceived the tax rates as a major obstacle is consistently lower than the average share of manufacturing firms in SSA that perceived tax rates as being a major obstacle.

Figure 35: Other taxes payable by businesses (% of commercial profits)[71]



Source: World Bank WDI.

Over the years, especially from the late 1990s onwards, the Government of Rwanda recognized the problems in the country's tax system and initiated various progressive tax reforms, which have contributed to improvements in the country's tax system. The improvement in the country's tax administration and tax policy has resulted in an increase in the country's tax revenues from under 10 per cent of GDP in 2000 to 16 per cent in 2016. The country has benefited from donor support, particularly from the United Kingdom's Department for International Development (DFID) to modernize the country's tax system. DFID provided Rwanda with a high level of technical and material assistance for two decades. This helped reduce the administrative tax burden on businesses (USAID, 2016).[72] The improvement of the country's tax system began with the creation of the Rwanda Revenue

[71] Other taxes payable by businesses include the amounts paid for property taxes, turnover taxes and other minor taxes such as municipal fees and vehicle and fuel taxes.

[72] Accessed at: https://www.usaid.gov/sites/default/files/documents/1865/Rwanda_DRM_case_study_briefing_note_FINAL.pdf Accessed on 14/09/2020.

Authority (RRA) in 1998, the replacement of an inefficient sales tax with a more modern value-added tax (VAT)[73] in 2001 and plans that were put in place to prepare the country to enter the East African Community (EAC) Customs Union in 2009 (effective 2010).

In the early days of RRA's, "tax compliance requirements were costly and time consuming for taxpayers. Filing for any of the domestic taxes, or even obtaining a tax clearance certificate, required that a taxpayer physically walk into an RRA office to process paperwork, then go to a bank for payment, and finally return to the RRA. This resulted in long queues at RRA offices and banks, especially around peak filing deadline times. The finalizing of a return, filing, and payment for VAT, income tax, or Pay as You Earn (PAYE) on average took over 23 days. In 2011 and 2012, the RRA launched e-filing and e-payment – greatly reducing these taxpayer compliance burdens. RRA reports that it now takes three days to get a taxpayer compliance certificate versus the 10 days that was previously customary. Taxpayers can also directly pay their tax at the bank without having to make double trips to the RRA" (USAID, 2016: 2). Moreover, the country also embarked on improving taxpayer education, outreach and assistance programmes. Such education and assistance programmes, for instance, helped the RRA staff bring more enterprises from the informal sector into the tax net. The programme helped increase SME registration from 42,538 to 90,485 from 2010/11 to 2011/12. Accordingly, this increased the revenue collected in the same period from RWF 385.2 billion to RWF 651.9 billion. The government also implemented tax industrial friendly policies. For instance, in recent years, the government has offered business tax incentives by eliminating VAT on imported inputs (USAID, 2016).

d) Inadequately skilled labour force

The quality and composition of the skilled labour force available to a firm plays a pivotal role in the competitiveness of the firm. Increasingly, specific types of skills, such as soft skills (i.e. teamwork, communication, language) and occupation-specific skills are gaining in importance, as well as high-end skills (for instance, IT skills) are necessary to maintain the momentum of innovation in firms (ILO, 2012; Choi et al., 2019). Acquired through a sequence of education, training and labour market programmes (Banerji et al., 2010; Tan et al., 2015), the importance of a workforce with adequate skills for firm performance is well documented in the literature, with extant studies suggesting that its dearth has a negative impact on firm performance (Tan et al., 2015).

Developing countries predominantly suffer from inadequate workforce skills. Relative to other regions, sub-Saharan Africa has the fastest-growing labour force, lack of human capital and the largest stock of ill-equipped adults. The region has fared extremely poorly on the World Bank's Human Capital Index (Choi et. al., 2019). About 61 per cent of working-age adults are not proficient in reading, and 19.5 per cent of adults aged 15 years and older can neither read nor write (UIL, 2017). The Rwandan government and the country's Workforce Development Authority (WDA) acknowledges that inadequate workforce skills (including soft and technical skills) are a major challenge in the country.[74] According to the PSDYE (2017), the skill constraints in the country are largely driven by relatively low

[73] Sales tax had produced about 2 per cent of GDP in revenue. The VAT system produced 3.3 per cent of GDP in revenue in its first year, rising to 4.0 per cent in 2005 and 5.2 per cent in 2016 (USAID, 2016).

[74] Accessed at: http://www.sdfrwanda.rw/ Accessed on 15/09/2020.

educational attainments — only 31 per cent of adults aged 25 and above have at least completed primary education while around 30 per cent are fully illiterate. This is reflected in the 2019 World Bank's Human Capital Index where Rwanda occupies the 142nd position (Choi et al., 2019).

Nonetheless, explorative evidence from the Enterprise Survey suggests that the share of manufacturing firms in Rwanda that perceived the inadequately skilled labour force to be a major obstacle to their business operations declined between 2006 and 2019, from 13.6% to 7.5%. More importantly, compared to the average share of manufacturing firms in other SSA countries, the average share of manufacturing firms in Rwanda that perceived an inadequately skilled labour force to be a major obstacle to their business operations was lower (Table 19). However, there are spatial disparities between Rwanda's regions and the average share of manufacturing firms in SSA. For instance, the share of manufacturing firms in Kigali (24.4 per cent) that perceived inadequate skills to be a major obstacle are all higher than those of the average share of manufacturing firms in SSA. On the other hand, the share of manufacturing firms in the Southern province (15.1 per cent) and Western province (13.8 per cent) that perceived inadequate skills to be a major obstacle to their business operations is lower than that of the average share of manufacturing firms in SSA (16.1 per cent). Hence, while Rwanda may be doing well on average, some regions are worse off compared to the average share of SSA manufacturing firm.

In terms of firm heterogeneity, more domestic-owned firms (7.3 per cent), SMEs (8.5 per cent), and non-exporting firms (9.1 per cent) perceive inadequate skills to be a major obstacle to business operations (Table 19).

Table 26: Average skilled and unskilled production workers, training, schooling, 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% highly skilled production workers	19.6	.	26.6	40.5	6.3	9.8	15.4	60.7	65.6	6.9	30.7	13.5
% semi-skilled production workers	13.1	.	22.5	27.2	3.9	6.6	12.5	42.8	45.7	4.1	23.8	7.1
% completed sec. school	55.6	76.5	57.7	74.5	40.8	32.7	52.9	78.4	76.4	43.2	74.9	41.1
% firm offering formal training programmes to workers	45.0	33.6	29.3	64.4	33.3	33.3	40.4	72.7	73.1	37.2	62.7	35.1

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

A careful look at the skill composition of production workers in Rwandan manufacturing firms in 2019 further lends support to the observed heterogeneity across firm types. Typically, there are more highly skilled production workers employed in foreign-owned (60.7 per cent), large firms (65.6 per cent), exporting firms (30.7 per cent), and firms located in Kigali (40.5 per cent) (Table 26). Less than 7 per cent of production workers employed in SMEs are highly skilled, domestic-owned firms (15.4 per cent), and non-exporting firms (13.5 per cent) (Table 26). Similarly, there are more semi-skilled production

workers and secondary school graduates in foreign-owned, large, and exporting manufacturing firms and manufacturing firms located in Kigali. These same firms tend to offer more formal training programmes to workers (Table 26). Except for firms offering formal training programmes to workers, the performance of manufacturing firms in Rwanda in all of these indicators is lower relative to the performance of average manufacturing firms in comparator SSA countries (Table 26).

This means that despite the decline and the lower share of firms in Rwanda that perceived an inadequately skilled labour force to be a major obstacle to business operations compared to the average share of manufacturing firms in other SSA countries, Rwanda seems to lag behind manufacturing firms in other comparator SSA in certain indicators as shown in Table 26. Consultations with stakeholders revealed that inadequately skilled labour is among the top four bottlenecks manufacturing firms in the country face. In addition to inadequately skilled labour, the stakeholders also mentioned that most industries lack the skills needed for market access (e.g. marketing and communication skills) to increase the visibility of their operations and products. These bottlenecks seem to have been identified by the country and are being addressed. Several skills development programmes have been rolled out in the country to address the skill bottleneck. Specifically, the Government of Rwanda through the Workforce Development Authority (WDA) received a credit from the World Bank for the implementation of its skills development strategy under the country's Skills Development Project (SDP). Implemented by WDA through the existing National Employment Program (NEP), the SDP aims to minimize the skills gaps experienced by private business operators in selected sectors such as energy, transportation and logistics, and manufacturing (with a focus on 'Made in Rwanda' products) by expanding training opportunities for the acquisition of quality, market-relevant skills needed to work in these sectors. The project provides grants for firms that enable the workforce in these firms to receive training from training providers. The beneficiary firms must have the potential to promote employment and reduce skills gaps to receive this grant. Successful firms are selected to receive the grants based on the number of employees, capacity and potential for value addition and improved productivity, increased foreign direct investment, and the potential of the sector to support growth in other sectors.[75]

e) Competition from informal sector

The informal sector in sub-Saharan Africa accounts for about 40 per cent of output and 80 per cent of employment in the region (ILO, 2013; African Development Bank, 2013).[76] The sector is characterized by small and inefficient firms, run by poorly educated entrepreneurs, and the majority of these informal firms are branded as unproductive (Mohammad and Islam, 2015; La Porta and Shleifer, 2011, 2014). Over the years, the informal sector has remained persistent, large, and has continued to function as a key part of the structure of the region's economies. The informal sector's unique attributes have made it very resilient and slow to change. In a region where employment opportunities in the formal sector are limited, the informal sector remains the only significant pathway to generate income.

[75] Accessed at: http://www.sdfrwanda.rw/ Accessed on 15/09/2020.
[76] This includes agricultural employment.

The Rwandan economy is no different from the general patterns observed in SSA countries. The economy of Rwanda is dominated by a large informal sector. According to the country's labour force survey in 2017, approximately 91 per cent of all workers and 84 per cent of non-agricultural workers are classified as informal workers (ILO, 2018). The sector is dominated by SMEs that are mostly household-owned, accounting for about 17 per cent of Rwanda's total output, and 90 per cent of all firms in the country (EDPS2, 2013). For instance, in 2018, the ILO conducted an extensive study of the country's booming building construction sector and found that the sector depends almost exclusively on an informal workforce (98 per cent are informal workers), many of which have very low skills and education levels (87 per cent have completed primary education or less). Very low wages, irregular payment of wages, worker occupational safety and health risks, irregular contracts, and limited training opportunities are the common challenges faced by the vast majority of workers in the informal sector (ILO, 2018).

When asked to name important reasons why they opt to operate in the informal economy, informal firms in Rwanda named factors such as lack of sufficient capital to operate a formal business, high taxes and increased business costs for operating a formal business, difficulty to understand how to formalize their business and no special benefits from registration as part of their decision to operate informally (Rukundo, 2015).

Typically, development literature considers informality and the activities of informal enterprises as largely negative for the economy. Also, evidence from establishment-level data reveals that market competitive behaviour of informal firms is one of the top three obstacles formal businesses face in the product market in SSA (Avenyo et al., 2019, Mendi and Costamagna, 2017; Gonzalez and Lamanna, 2007). This competition occurs through prices at the local level, where competitive interactions are found to occur in the product market. For instance, informal firms have a competitive advantage of lower labour costs and face lower or no taxes. All of these aspects translate into lower prices for goods produced by the informal enterprise. Research has also been carried out to investigate the effects of informal competition on the performance of innovative products introduced by formal firms. Using the World Bank's Enterprise Survey with the Innovation Follow-up Survey for five sub-Saharan African countries, Avenyo et al (2019) finds that local informal competition has a robust negative effect on the product innovation intensity of formal firms, while within industry, informal competition enhances innovative sales. The authors argue that local informal competition harms the performance of product innovation, but only for formal firms that lack strategic collaborative 'footholds' in the informal economy.

Consistent to the above and despite the substantial drop in the share of formal manufacturing firms in Rwanda that perceived the informal sector as being a major business obstacle, competition from the informal sector was the second major obstacle in 2019 that formal manufacturing firms in the country faced. Between 2006 and 2019, the share of formal manufacturing firms in Rwanda that perceived the informal sector as a major obstacle to their business operations declined by 10.4 per cent (from 23.7 per cent in 2006 to 13.3 per cent in 2019), which is higher than the average share of non-manufacturing firms in the country (10 per cent) but lower than the average share of manufacturing firms in SSA (32.3 per cent) that also perceived it as a major obstacle. There are spatial differences in the shares of

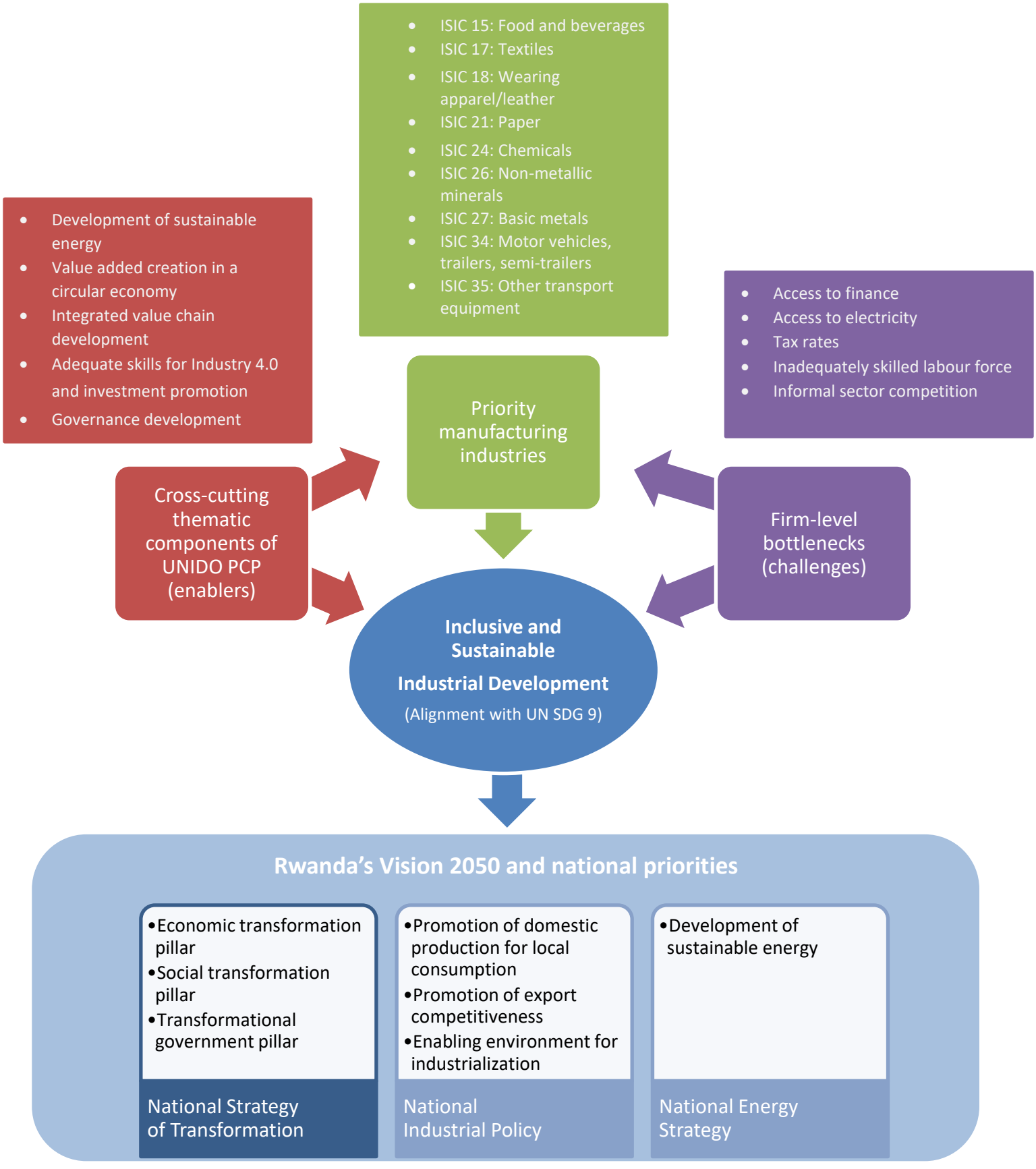
manufacturing firms that perceived the informal sector to be a major obstacle for their business operations. For instance, the share of formal manufacturing firms in Kigali that perceived the informal sector as a major obstacle was 15.1 per cent, while the shares of the formal manufacturing firms in the Southern and Western provinces were 10.2 per cent and 13.8 per cent, respectively, which were all lower than the 32.3 per cent average share of manufacturing firms in SSA (Table 19). Also, more domestic, non-exporting firms and SMEs perceived the informal sector to be a stronger obstacle to their business operations than for other types of firms. Moreover, in Rwanda, formally registered firms reporting payroll information to authorities are more likely to enter the export market (Frazer and Van Biesebroeck, 2019).

Consultations with stakeholders revealed that the size of the informal sector itself may pose a severe competition to formal firms, given the size advantage and limited regulation faced by these informal enterprises. However, the exact magnitude of these obstacles to formal manufacturing firms is unknown, given that the majority of these informal enterprises are small enterprises with a limited capacity to operate on the scale of formal manufacturing firms.

SECTION 4: FINAL SUGGESTIONS FOR PCP DESIGN

The objective of this PCP diagnostic study was to reveal thematic components, priority industries within the manufacturing sector as well as key bottlenecks as perceived by firms. The primary purpose of these findings is to contribute to further discussions on project design and potential points of entry for interventions with a substantial impact on Rwanda's industrial development. For this reason, the synthesis of the analyses across the macro-, meso- and micro-level are summarized in Figure 36along the national priorities laid down in national policy and strategy documents. The results of both the thematic components and the priority industries correspond closely with Rwanda's national policy objectives. Moreover, the key bottlenecks identified in this report overlap with those discussed in the various national policy documents. The forthcoming dialogue between the Government of Rwanda and UNIDO can be facilitated by an appropriate PCP governance structure. A governance system aligned with the recommended PCP framework will ensure a smoother and more efficient collaboration between UNIDO, the Government of Rwanda, other national stakeholders and development partners, which in turn will ease effective implementation of identified activities. It is recommended to establish a national coordination body to lead, guide and supervise the programme's implementation, with focal points representing each component. These focal points can be matched with UNIDO's technical focal points, which will ensure direct channels of communication and facilitate joint work. Equally useful would be the establishment of working groups which, coordinated by the focal points and comprising the wider PCP stakeholders, could support, where necessary, the national coordination body.

Figure 36: Strategic map for Programme for Country Partnership (PCP) Rwanda



Source: UNIDO

References

Chapter 1

AfDB (2014), Eastern Africa's Manufacturing Sector. Promoting Technology, Innovation, Productivity and Linkages, Rwanda Country Report, November 2014.

Behuria, P. (2019), Twenty-first Century Industrial Policy in a Small Developing Country: The Challenges of Reviving Manufacturing in Rwanda, Development and Change, 50(4), 1033-1062.

Bimenyimana S, Asemota G.N.O., Li L (2018), The State of the Power Sector in Rwanda: A Progressive Sector With Ambitious Targets, Frontiers in Energy Research, 6, pp. 1-14.

Boston Consulting Group (2016), Sprinting to Value in Industry 4.0. Perspectives from and Implications for U.S. Manufacturers, presentation, December 2016. https://www.slideshare.net/TheBostonConsultingGroup/sprinting-to-value-in-industry-40.

Calabrese L. Papadavid P. Tyson J., Rwanda: financinging for manufacturing, SET (Supporting rconomic transformation) working paper, https://set.odi.org/wp-content/uploads/2017/06/Financing-for-Manufacturing-Rwanda-June-2017.pdf

Chang, H.-J. (2010), 'Hamlet without the Prince of Denmark: How development has disappeared from today's "development" discourse', in: Khan, S. Christiansen, J. (eds.), Towards New Developmentalism: Market as Means rather than Master, Abingdon: Routledge.

Cimoli, M., Dosi, G., Nelson, R., Stiglitz, J.E. (2009), 'Institutions and Policies Shaping Industrial Development: An Introductory Note', in: Cimoli, M., Dosi, G., Stiglitz, J.E. (eds), Industrial Policy and Development. The Political Economy of Capabilities Accumulation, Oxford University Press, Oxford. New York.

Eustache, H., Sandoval, D., Garba Wali, U., Venant, K. (2019), Current Status of Renewable Energy Technologies for Electricity Generation in Rwanda and Their Estimated Potentials, Energy and Environmental Engineering 6(1), pp. 8-15.

Government of Rwanda (2017), 7 Years Government Programme: National Strategy for Transformation (NST 1), 2017 – 2024, Government of Rwanda, Kigali.

Hausmann, R., Chauvin, J. (2015), Moving to the Adjacent Possible: Discovering Paths for Export Diversification in Rwanda, CID Working Paper, 294, April 2015.

Hausmann, R., Hwang, J., Rodrik, D. (2007) What you export matters, Journal of Economic Growth, 12, pp. 1–25.

IMF (2018), World Economic Outlook: Cyclical Upswing, Structural Change, April 2018. Washington, DC: IMF.

IMF (2019), Staff Report for the 2019 Article IV Consultation and Request for a Three-Year Policy Coordination Instrument, IMF Country Report No. 19/211 , July 2019.

IMF (2020), Rwanda: Request for Disbursement Under the Rapid Credit Facility, IMF Country Report No. 20/207, June 2020.

INSEAD (2020), The Global Talent Competitiveness Index 2020. Global Talent in the Age of Artificial Intelligence. Available at: https://www.insead.edu/global-indices.

Kabera T. and H. Nishimwe (2019), Systems analysis of municipal solid waste management and recycling system in east Africa: benchmarking performance in Kigali city, Rwanda, E3S Web of Conferences 80, 03004, https://doi.org/10.1051/e3sconf/20198003004

Kabera, T., D. Wilson and H. Nishimwe (2019), Benchmarking performance of solid waste management and recycling systems in East Africa: Comparing Kigali Rwanda with other major cities, Waste Management & Research, Vol. 37(1) supplement 58-72.

Ministry of Environment of Rwanda (2019), National environment and climate change policy, June 2019.

Ministry of Infrastructure (2015), Rwanda's Energy Policy, March 2015.

Ministry of Infrastructure (2016), Rural Electrification Strategy, June 2016.

Ministry of Trade and Industry (2011), National Industrial Policy, April 2011.

Ministry of Trade and Industry (2015a), Domestic Market Recapturing Strategy, March 2015.

Ministry of Trade and Industry (2015b), National Export Strategy II.

Ministry of Trade and Industry (2017), Made in Rwanda Policy, November 2017.

Ministry of Trade and Industry (2018), Revised SEZ Policy. Addressing the infrastructure constraint to industrialisation in Rwanda, January 2018.

National Institute of Statistics of Rwanda (NISR) (2018), Labour Force Survey Report. Annual Report 2018, December 2018.

National Institute of Statistics of Rwanda (NISR) (2019), Gross Domestic Product - National Accounts (Fiscal Year 2018/19), September 2019.

Pritchett, L. (2000), Understanding Patterns of Economic Growth: Searching for Hills among Plateaus, Mountains, and Plains, The World Bank Economic Review, 14(2), pp. 221–50.

Rajashekar, A., A. Bowers, A. Sebarenzi Gatoni (2019), Assessing waste management services in Kigali, July.

Reinert, E.S. (2007), 'How Rich Countries Got Rich – and Why Poor Countries Stay Poor', Carroll & Graf, New York.

REMA (2019), Rwanda compendium of environment statistics 2018, Rwanda Environment Management Authority (REMA), February, https://www.rema.gov.rw/index.php?id=39

REMA (2009), Rwanda State of Environment and outlook report 2009, Rwanda Environment Management Authority, https://www.rema.gov.rw/soe/

Republic of Rwanda (2004), Strategic Plan for the Transformation of Agriculture in Rwanda (PSTA I). Ministry of Agriculture and Animal Resources, Republic of Rwanda (ROR), Kigali.

Republic of Rwanda (2011), Green Growth and Climate Resilience National Strategy for Climate Change and Low Carbon Development, October 2011.

Rodrik, D., 2018. New Technologies, Global Value Chains, and Developing Economies, NBER Working Paper, 25164.

Schwab, K. (2017) The Fourth Industrial Revolution, Crown Publishing: New York.

Szirmai, A. (2012), Industrialisation as an engine of growth in developing countries, 1950–2005, Structural Change and Economic Dynamics, 23(4), pp. 406-420.

Timmer, M.P. and Szirmai, A. (2000), 'Productivity growth in Asian Manufacturing: the structural bonus hypothesis examined', Structural Change and Economic Dynamics, 11, pp. 371-392.

UNIDO (2020), Industrial Development Report 2020. Industrializing in the digital age. Vienna.

UN Economic Commission for Africa, TradeMark East Africa (2020) Creating a unified regional market: towards the implementation of the African continental free trade area in East Africa, January 2020, available at: https://www.uneca.org/publications/creating-unified-regional-market-towards-implementation-african-continental-free-trade.

World Bank and Government of Rwanda (2019), Future Drivers of Growth in Rwanda: Innovation, Integration, Agglomeration, and Competition. World Bank, Washington, DC.

Chapter 2

Balassa, B. (1965) *Trade liberalization and revealed comparative advantage*. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9957.1965.tb00050.x Accessed date: 05 August 2018

Government of Rwanda (2017) National Strategy for Transformation (NST1). http://www.minecofin.gov.rw/index.php?id=150 Accessed date: Accessed date: 01 September 2020

Haraguchi, N. and Rezonja, G. 2010. In Search of General Patterns of Manufacturing Development. UNIDO Working Paper 02/2010. Vienna: United Nations Industrial Development Organization.

Haraguchi, N. 2014. Patterns of structural change and manufacturing development. UNIDO Working Paper 07/2014. Vienna: United Nations Industrial Development Organization.

Haraguchi, N., 2015. Patterns of Structural Change and Manufacturing Development. In: *Routledge Handbook of Industry and Development*, eds. Weiss, J. and Tribe, M., New York, NY: Routledge, pp. 38–64.

Katz, J.2000. Structural Change and Labour Productivity Growth in Latin American Manufacturing Industries 1970-96. World Development. 28(9): 1583-1596.

Lin, J. and Chang, H-J.2009. Should Industrial Policy in Developing Countries Conform to Comparative Advantage or Defy it? A Debate between Justin Lin and Ha-Joon Chang. *Development Policy Review*. 27(5): 483-502.

Ministry of Trade and Industry, Rwanda (2015) Rwanda Domestic Recapturing Strategy. https://www.tralac.org/images/News/Documents/Rwanda%20Domestic%20Market%20Recapturing%20Strategy%20March%202015.pdf Accessed date: 01 September 2020

Ministry of Trade and Industry, Rwanda (2011) National Industrial Policy. http://www.minicom.gov.rw/fileadmin/minicom_publications/policies/Industrial_Policy-2.pdf Accessed date: Accessed date: 01 September 2020

National Industrial Research and Development Agency, Rwanda (2020) Open calls. https://www.nirda.gov.rw/open-calls/#:~:text=The%20NIRDA%20Open%20calls%20are,for%20domestic%20and%20international%20markets. Accessed date: Accessed date: 01 September 2020

UNIDO (2013) Industrial Development Report 2013

https://www.unido.org/sites/default/files/2013-12/UNIDO_IDR_2013_main_report_0.pdf

Accessed date: 30 August 2020

UN Comtrade (2020) International Trade Statistics Database. https://comtrade.un.org/ Accessed date: 30 August 2020

Chapter 3

Abdisa, L. (2018). Power outages, economic cost, and firm performance: Evidence from Ethiopia. *Utilities Policy*, 53, 111-120.

Abeberese, A. (2013). Electricity cost and firm performance: evidence from India. *Review of Economics & Statistics*, 99(3), 839-852.

African Development Bank. (2013). Recognizing Africa's informal sector. Accessed at: https://blogs.afdb.org/afdb-championing-inclusive-growth-across-africa/post/recognizing-africas-informal-sector-11645. Date Accessed 12/09/2020.

Aker, J & Mbiti, I. (2010). Mobile phones and economic development in Africa, *Journal of Economic Perspectives*, 24(3), 207–232.

Andersen, T., & Dalgaard, C-J. (2013). Power outages and economic growth in Africa. *Energy Economics*, 38, 19-23.

Arnold, J. M, Javorcik, B & Mattoo, A. (2011). Does services liberalization benefit manufacturing firms?: Evidence from the Czech Republic, *Journal of International Economics*, 85(1), 136–146.

Arnold, J. M, Javorcik, B, Lipscomb, M & Mattoo, A. (2016). Services reform and manufacturing performance: Evidence from India, *The Economic Journal*, 126(590), 1–39.

Arnold, J. M, Mattoo, A & Narciso, G. (2008). Services inputs and firm productivity in Sub-Saharan Africa: Evidence from firm-level data, *Journal of African Economies*, 17(4), 578–599.

Avenyo, E. K., Konte, M., & Mohnen, P. (2019). Product Innovation and Informal Market Competition in sub-Saharan Africa. *Journal of Evolutionary Economics*. https://doi.org/10.1007/s00191-020-00688-2.

Banerji, A., Cunningham, W., Fiszbein, A., King, E., Patrinos, H., Robalino, D., & Tan, J.-P. (2010). Stepping up Skills for More Jobs and Higher Productivity, World Bank, Washington DC. Accesed at: https://elibrary.worldbank.org/doi/pdf/10.1596/27892 Date Accessed. 12/09/2020.

Barro, R. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(S5), 103-125.

Barro, R., & Sala-i-Martin, X. (1992). Public finance models of economics. *Review of Economic Studies*, 59(4), 645-661.

Chang, H-J., Hauge, J. and Irfan, M. (2016). *Transformative Industrial Policy for Africa*. Addis Ababa: United Nations Economic Commission for Africa (UNECA).

Choi, J., Dutz, M., Usman, Z. (2019). The future of work in Africa: Harnessing the potential of digital technologies for all. Washington, DC: World Bank.

Cole, A., Elliott, R., Occhiali, G., & Strobl, E. (2018). Power outages and firm performance in Sub-Saharan Africa. *Journal of Development Economics*, 134, 150-159.

EDPRS2 (2013). Economic Development and Poverty Reduction Strategy II. Accessed at: http://www.minecofin.gov.rw/fileadmin/templates/documents/NDPR/EDPRS_2.pdf Date accessed 11/09/2020.

Eubank, N. (2012). Taxation, political accountability, and foreign aid: Lessons from Somaliland. *Journal of Development Studies*, 48(4), 465–480.

Fowowe, B. (2017). Access to Finance and Firm Performance: Evidence from African Countries. *Review of Development Finance*, 7(1), 6-17

Frazer, G & Van Biesebroeck, J. (2019), The Extent of Engagement in Global Value Chains by Firms in Rwanda. Policy Research Working Paper No. WPS 8979. Washington, D.C.: World Bank Group.

Gadenne, L. (2011). Tax me, but spend wisely: the political economy of taxes, evidence from Brazilian local governments. *American Economic Journal: Applied Economics*, 9(1), 274-314.

Gonzalez, A.S. & Lamanna, F. (2007). Who Fears Competition from Informal Firm? Evidence from Latin America. World Bank Policy Research Paper. No. 4316. World Bank. Washington D.C.

ILO (2012), International Standard Classification of Occupations ISCO-08, Vol. 1, The International Labor Organization, Geneva.

ILO. (2018). Laying a Foundation for Better Working Conditions. A Market Analysis in Rwanda's Building Construction Sector. ILO, Geneva. Access at: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_644796.pdf. Date Accessed 12/09/2020.

La Porta, R., & Shleifer, A. (2011). The unofficial economy in Africa. NBER Working Paper16821. Cambridge, MA: National Bureau of Economic Research.

La Porta, R., & Shleifer, A. (2014). Informality and development. NBER Working Paper20205. Cambridge, MA: National Bureau of Economic Research.

Liu, Y., & Mao, J. (2019). How Do Tax Incentives Affect Investment and Productivity? Firm-Level Evidence from China. *American Economic Journal: Applied Economics*, 11(3), 261-91

Manova, K. (2013). Credit Constraints, Heterogeneous Firms, and International Trade. *Review of Economic Studies,* 80, 711–744.

Mendi, P. & Costamagna, R. (2017). Managing Innovation Under Competitive Pressure from Informal Producers. Technological Forecasting and Social Change, 114: 192-202.

Mohammad, Amin, and Islam Asif. 2015. "Are Large Informal Firms More Productive than the Small Informa Firms? Evidence from Firm-Level Surveys in Africa." *World Bank. Washington, DC* 74: 374–85.

OECD. (2013). Tax and development. Accessed at: https://www.oecd.org/ctp/tax-global/what-drives-tax-morale.pdf Date Accessed 10/09/2020.

OECD. (2013). Tax and development. Accessed at: https://www.oecd.org/ctp/tax-global/what-drives-tax-morale.pdf Accessed Date: 09/09/2020.

PSDYE. (2017). Private Sector Development and Youth Employment Strategy. Accessed at http://www.minecofin.gov.rw/fileadmin/templates/documents/NDPR/Sector_Strategic_Plans/PSD_YE.pdf Date Accessed 14/04/2020.

Rahaman, M. (2011). Access to Financing and Firm Growth. *Journal of Banking & Finance*, 35(3), 709-723.

Rukundo, J.B. (2015). Productivity and Informality in Rwanda. Evidence from Food Processing Sector. Accessed at: file:///C:/Users/User1/AppData/Roaming/Microsoft/Windows/Network%20Shortcuts/ProductivityandInformalityinRwanda.EvidencefromtheFoodProcessingSector.pdf Date Accessed 12/09/2020.

Tan, H., Bashir, S., & Tanaka, N. (2016). Skill use, skill deficits, and firm performance in formal sector enterprises evidence from the Tanzania enterprise skills survey, 2015. World Bank Policy Research Working Paper. No. 7672. World Bank. Washington D.C.

UIL (UNESCO Institute for Lifelong Learning). (2017). The Status of Adult Learning and Education in Sub-Saharan Africa: Regional Report. Hamburg: UIL

USAID. (2016). Domestic Resource Mobilization: Case Study of Rwanda 1990-2016. Accessed at https://www.usaid.gov/sites/default/files/documents/1865/Rwanda_DRM_case_study_briefing_note_FINAL.pdf Date accessed 14/09/2020.

Van Biesebroeck, J & Mensah, E.B. (2019). The Extent of GVC Engagement in Sub-Saharan Africa. Policy Research Working Paper No. WPS 8937. Washington, D.C.: World Bank Group.

World Bank Doing Business. (2019). Access at https://www.doingbusiness.org/en/rankings Date accessed 10/09/2020.

Appendices

I. Appendix to Section 1

Table A.I.1: List of comparator countries in sub-Saharan Africa

Country	Country code	World Bank income group
Burundi	BDI	Low income
Kenya	KEN	Lower middle income
South Sudan	SSD	Low income
Tanzania	TZA	Lower middle income
Uganda	UGA	Low income
Mali	MLI	Low income
Malawi	MWI	Low income
Chad	TCD	Low income
South Africa	ZAF	Upper middle income
Ethiopia	ETH	Low income

II. Appendix to Section 2

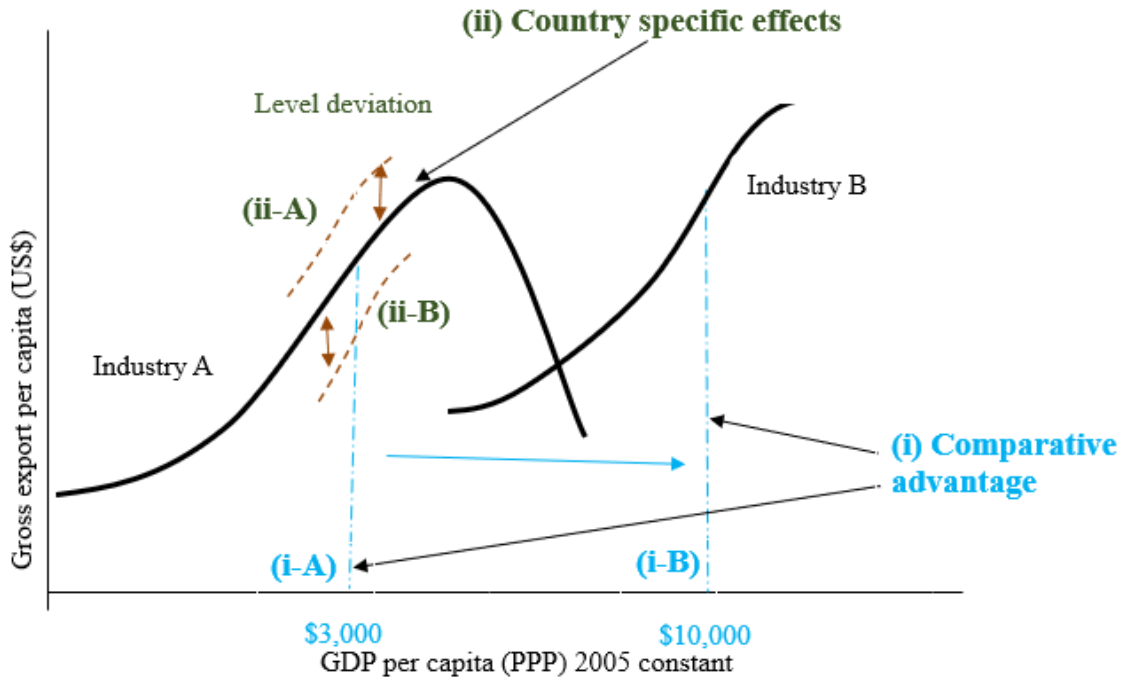
The theoretical concept of the comparative advantage is illustrated in Figure A1:

- (i) Comparative advantage: as illustrated in Figure A1, for example, Industry A can be considered a low-tech, labour-intensive industry that develops rapidly at a relatively early stage of development, e.g. USD 3,000 GDP per capita (constant 2005 PPP) (i-A), while Industry B, a capital- and technology-intensive industry, is likely to emerge and grow rapidly at a higher income level, e.g. USD 10,000 GDP per capita (constant 2005 PPP) (i-B).

- (ii) Country-given effects: while the relationship between income levels and manufacturing structure has some elements of universality (as countries follow a more or less similar path of structural change) as income increases, geographic and demographic conditions give countries natural advantages or disadvantages in the development of certain industries (Katz, 2000). For example, holding other conditions constant, abundant natural resources endowment tend to work against manufacturing development (Haraguchi and Rezonja, 2010).

- (iii) Other long-term conditions: finally, the course of manufacturing structural change is not only determined by the universal effects of income levels and given demographic and geographic conditions, but there is also space for individual countries to have an autonomously evolving structure. Therefore, the country-created or specific conditions, such as history, culture and policy, are also significant (Lin and Chang, 2009). Some countries (ii-A) have characteristics that give them distinct advantage (upward) over others in relation to manufacturing export per capita for a given level of income, while others (ii-B) have characteristics that give them a lower performance (downward) consistently over a long period of time.

Figure A1: Schematic representation of the role of comparative advantage and country-specific and time-specific effects in manufacturing development



Source: Haraguchi (2014, pp.29)

Please see Haraguchi (2014, pp. 30) for model used in projecting the patterns of comparative advantage and country-specific and time-specific effects.

III. Appendix to Section 3

a) Bottleneck analysis: methodology and survey Information

Methodology and interpretation of bottleneck analysis

The methods used are discussed to identify the bottlenecks Rwandan firms face, particularly formal manufacturing firms, formal non-manufacturing firms and formal manufacturing firms in comparator SSA countries, using information from a series of survey rounds of the World Bank Enterprise Survey. A careful and thorough analysis of the survey data resulted in the identification of 17 overall factors. Each of the 17 factors represents a potential bottleneck that firms in Rwanda face in their daily operations. The factors are listed below in the order they appear in the WBES:

- Electricity
- Telecommunication
- Transportation
- Customs and trade regulation
- Informal sector
- Access to land
- Courts
- Crime
- Tax rates
- Tax administration
- Business licensing and permits
- Macroeconomic stability
- Political stability
- Corruption
- Access to finance
- Labour regulation
- Inadequately skilled labour force.

All of these factors represent potential bottlenecks to the operations of firms, albeit at different degrees. Specifically, in the survey, participating firms were asked to rate how much the specific factor acted as an obstacle to their current business operations. Survey participant firms could choose from five answers, ranging from 'No obstacle; minor obstacle, moderate obstacle, major obstacle, to very severe obstacle'). To identify the lists of interventions and priority focus areas for the government and policymakers, we rank these factors according to their level of severity by adding the share of firms identifying each of the listed factors as "a very severe or major bottleneck" to the operation of their business. This is our adopted strategy to define the severity of a given problem. Although we compare the severity of these bottlenecks in Rwanda to other comparator countries in SSA to help in the identification of priority areas, even if the severity of the problem is comparably lower in Rwanda, it does not make the problem less severe for firms in Rwanda. We pay particular attention to analyse and discuss in detail the most severe bottlenecks.

The WBES database we used dated back to 2006. Data for the recently released World Bank Enterprise Survey 2019/2020 were also included. We used three waves of the WBES for the years 2006, 2011 and 2019/2020 to observe overall trends and the development of bottlenecks manufacturing firms in Rwanda have faced over the last 13 to 14 years. We ranked these factors according to their level of severity using results from the 2019/2020 survey data since it is the latest available data in the survey for Rwanda and also provides a better picture of how these bottlenecks affect manufacturing firms' current business operations.

Given the priority mandate of the PCP to focus on industrialization, we rank and compare these potential obstacles first at the level of Rwanda's manufacturing sector, compare the potential obstacles across locations, across firm size, ownership structure, and across exporting and non-exporting firms. We additionally documented how these factors as ranked by manufacturing firms, compared to the average of non-manufacturing firms in Rwanda and averages of comparator manufacturing firms (in other SSA in the WBES as shown in Table A.III.1). The table reports values per group (column) and answer (row). The first cell is interpreted as the share of manufacturing firms in Rwanda that reported that Factor 1 represented a "very severe or major bottleneck" to the operation of their business. This was then compared to the share of non-manufacturing firms in Rwanda that gave the same response to Factor 1, across the averages of comparator manufacturing countries in SSA, and to the other dimensions of comparison listed above. The latest available data in the WBES database is used for the comparator countries. Details on the databases and the questions code from the Enterprise Surveys used for the analysis are provided and listed in Table A.III.2-6.

Answers to the questions in the series of the World Bank Enterprise Survey ranges from providing an absolute number (for example, losses of % of sales due to power outages) or a share of firms naming a factor or choosing from a category (for example, did a firm experience power outages in the last fiscal year and give a 'Yes, or No' response). When answers in the table are presented in terms of numbers or shares, they refer to averages. When answers are provided in terms of choosing from a category, the corresponding values reported in the table refer to the share of firms that choose a specific category.

Table A.III.1: Typical table for analysis

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs
Factor 1	.	.	.	.	.	.	.	.	.	.
Factor 2	.	.	.	.	.	.	.	.	.	.
Factor 3	.	.	.	.	.	.	.	.	.	.

Table A.III.2: Country and sector coverage, WB Enterprise Survey

	WB Enterprise Survey year
Angola	2010
Benin	2016
Botswana	2010
Burkina Faso	2009
Burundi	2014
Cameroon	2016
Cape Verde	2009
Central African Republic	2011
Chad	2018
Congo	2009
Côte d'Ivoire	2016
DRC	2013
Djibouti	2013
Eswatini	2016
Ethiopia	2015
Gabon	2019
The Gambia	2018
Ghana	2013
Guinea	2016
Guinea-Bissau	2006
Kenya	2018
Lesotho	2016
Madagascar	2013
Malawi	2014
Mali	2016
Mauritania	2014
Mauritius	2009
Mozambique	2018
Namibia	2014
Niger	2017
Nigeria	2014
Rwanda 2006	2006
Rwanda 2011	2011
Rwanda 2019	2019
Senegal	2014
Sierra Leone	2017
South Africa	2007
South Sudan	2014
Togo	2016
Uganda	2013
Zambia	2019
Zimbabwe	2016

Note: We use the latest available data for all comparator countries in SSA in the WBES.
Source: World Bank Enterprise Survey.

Table A.III.3: Country and sector coverage, WB Enterprise Survey

	Number of observations (total)	Number of observations (manufacturing only)
Angola	360	141
Benin	150	70
Botswana	268	87
Burkina Faso	394	96
Burundi	157	60
Cameroon	361	102
Cape Verde	156	68
Central African Republic	150	37
Chad	153	74
Congo	151	38
Côte d'Ivoire	361	106
DRC	529	243
Djibouti	266	64
Eswatini	150	75
Ethiopia	848	377
Gabon	179	37
The Gambia	151	63
Ghana	720	377
Guinea	150	27
Guinea-Bissau	159	50
Kenya	1,001	455
Lesotho	150	76
Madagascar	532	282
Malawi	523	176
Mali	185	99
Mauritania	150	50
Mauritius	398	150
Mozambique	601	287
Namibia	580	170
Niger	151	41
Nigeria	2,676	1,147
Rwanda 2006	212	59
Rwanda 2011	241	81
Rwanda 2019	360	120
Senegal	601	247
Sierra Leone	152	77
South Africa	937	680
South Sudan	738	90
Togo	150	45
Uganda	762	382
Zambia	601	175
Zimbabwe	600	289

Note: We use the latest available data for all comparator countries in SSA in the WBES. The observations in the table are the maximum number of observations. However, not every firm participating in the survey responded to every question and often, there was a lower number of observations in terms of response rate. This usually happens when a participating firm either did not know the answer to the question being asked, the question did not apply to the firm or the firm simply did not want to answer.
Source: World Bank Enterprise Survey.

Table A.III.4: Manufacturing sector coverage, WB Enterprise Survey

	Food & Beverages	Textile & Leather	Wood Products	Non-Met. Mineral	Basic Metals	Chem	Rubber & Plastic	Paper & Paper	Printing and Publishing	Coke, ref. Petroleum,
Angola	30	7	9	3	7	3	1		2	
Benin	17	1	2	2	2	10	2		19	
Botswana	9	19	4	5	3	6	3	1	10	
Burkina Faso	20	9	5	2	10	8	5	1	13	
Burundi	28	2	2			6	3		13	
Cameroon	20	9	8		4	6	6	2	15	2
Cape Verde	22	9	11	1	2	3	1		3	
Central African Republic	21				1	2	1		7	
Chad	12	23		1		1			12	
Congo										
Côte d'Ivoire	30	16	11	1	2	9	7	1	7	
DRC	44	42	13	14	1	21	2	3	9	1
Djibouti	32	1		6	5	3			1	1
Eswatini	20	12	3	8	1	3	5	2	7	
Ethiopia	89	70	8	63	13	13	27	3	27	
Gabon										
Gambia	9	17	1	1		1			18	
Ghana	57	35	1	21	10	26	25	3	62	3
Guinea	4	1	2	1		5			7	
Guinea-Bissau	10	4	20	5		1			2	
Kenya	143	68	9	23	4	49	39	13	14	
Lesotho	8	33		17		2	2	2	1	
Madagascar	70	65	36	9	4	19	10		18	1
Malawi	45	31	12	5	2	16	15	5	26	2
Mali	33	22	2	1	4	10	5		4	1
Mauritania	33		1	3	2		1	3	7	1
Mauritius	79	57	6	1	4	7	10	1	12	
Mozambique	83	23	28	6	1	4	13	2	10	1
Namibia	29	20	10	20	7	6	6	4	7	2
Niger	18	5			2	2			8	
Nigeria	272	239	57	182	42	39	26	7	164	14
Rwanda 2006	21	7	1	1	0	7	3	2	7	0
Rwanda 2011	24	6	4	3	2	9	5	1	15	0
Rwanda 2019	65	3	3	8	2	1	4	5	2	0
Senegal	126	30	23	3	5	12	8	3	15	
Sierra Leone	12	20	1	2	6	4	2		6	
South Africa	114	130	31	8	2	83	22	12	18	2
South Sudan	32	1	1	9	3	3			1	1
Tanzania	91	94	18	15	4	11	17		19	2
Togo	9	1		2	1	8	4	1	4	
Uganda	118	59	22	14	3	9	5	5	15	1
Zambia	74	15	10	8	7	13	7	2	9	1
Zimbabwe	94	86	6	8	5	11	8	3	16	3

Note: We use the latest available data for all comparator countries in SSA in the WBES.
Source: World Bank Enterprise Survey.

Table A.III.5: Coverage of other dimensions, WB Enterprise Survey

Country	Domestically owned firm	Foreign-owned firm	Large firms	SMEs	Exporting firm	Non-exporting firm
Angola	255	105	45	315	20	240
Benin	119	31	32	118	44	106
Botswana	176	92	45	223	31	237
Burkina Faso	339	55	60	334	48	346
Burundi	137	20	12	145	27	130
Cameroon	312	49	51	310	75	286
Cape Verde	129	27	25	131	10	146
Central African Republic	120	30	11	139	23	127
Chad	133	20	14	139	24	129
Congo	90	61	16	135	15	136
Côte d'Ivoire	262	99	53	308	63	298
DRC	425	104	25	504	50	479
Djibouti	238	28	18	248	57	209
Eswatini	116	34	18	132	38	112
Ethiopia	808	40	177	671	88	760
Gabon	97	82	19	160	21	158
Gambia	137	14	12	139	25	126
Ghana	628	92	61	659	141	579
Guinea	136	14	13	137	11	139
Guinea-Bissau	147	12	2	157	10	149
Kenya	921	80	186	815	304	697
Lesotho	125	25	28	122	36	114
Madagascar	436	96	83	449	112	420
Malawi	367	156	84	439	66	457
Mali	144	41	35	150	54	131
Mauritania	144	6	25	125	41	109
Mauritius	317	81	58	340	101	297
Mozambique	445	156	101	500	123	478
Namibia	431	149	28	552	66	514
Niger	118	33	15	136	30	131
Nigeria	2,173	503	189	2,487	627	2,049
Rwanda 2006	180	32	16	196	19	193
Rwanda 2011	204	37	37	204	26	215
Rwanda 2019	331	29	54	306	123	237
Senegal	542	59	47	554	76	525
Sierra Leone	137	15	18	134	14	138
South Africa	846	91	200	737	225	712
South Sudan	620	118	10	728	31	707
Tanzania	756	57	80	733	128	685
Togo	115	35	23	127	58	92
Uganda	672	90	66	696	160	602
Zambia	467	134	105	496	125	476
Zimbabwe	547	53	95	505	98	502

Note: We use the latest available data for all comparator countries in SSA in the WBES.
Source: World Bank Enterprise Survey.

Table A.III.6: Coverage of other dimensions, WB Enterprise Survey

WBES Code	WBES Questions
country	Country
idstd	Establishment Id
year	Year of survey
a3ax	Location of Establishment (city/town/village)
b5	Establishment year
stra_sector	Sector
d1a2	ISIC Rev 3.1 4-digit code that best applies to the establishment's main activity or product 2-digit were used to map to 'priority sectors'
b2a	What percentage of this firm is owned by private domestic individuals, companies or organizations?
b2b	What percentage of this firm is owned by private foreign individuals, companies or organizations?
b2c	What percentage of this firm is owned by government or state?
b4	Amongst the owners of the firm, are there any females? (Y/N)
b7a	Is the Top Manager female? (Y/N)
c6	Over the last fiscal year, did this establishment experience power outages? (Y/N)
c7	In a typical month, over the last fiscal year, how many power outages did this establishment experience?
c8	How long did these power outages last on average?
c9a	Please estimate the losses that resulted from power outages either as a percentage of total annual sales
c10	Over the last fiscal year, did this establishment own or share a generator? (Y/N)
c11	In the last fiscal year, what percentage of this establishment's electricity came from a generator or generators that the establishment owned or shared?
c15	Over the last fiscal year, did this establishment experience insufficient water supply for production?
c16	In a typical month, over the last fiscal year, how many incidents of insufficient water supply did this establishment experience?
c17	How long did these incidents of insufficient water supply last on average?
c30a	To what degree is Electricity an obstacle to the current operations of this establishment?
c22a	Do you currently communicate with clients and suppliers through e-mails? (Y/N)
c22b	Does the establishment has its own website? (Y/N)
c30b	To what degree is Telecommunications an obstacle to the current operations of this establishment?
d2	In the last fiscal year, what was this establishment's total annual sales?
d3a	In the last fiscal year, what percentage of this establishment's sales were national sales?
d3b	In the last fiscal year, what percentage of this establishment's sales were indirect exports (sold domestically to third parties that export products)? Used to create group exporters vs. non-exporters
d3c	In the last fiscal year, what percentage of this establishment's sales were direct exports? Used to create group exporters vs. non-exporters
d12a	In the last fiscal year, as a proportion of all material inputs or supplies purchased that year, what percentage of this establishment's material inputs, or supplies were material inputs or supplies of domestic origin?
d12b	In the last fiscal year, as a proportion of all material inputs or supplies purchased that year, what percentage of this establishment's material inputs, or supplies were material inputs or supplies of foreign origin?
d14	In the last fiscal year, how many days did it take the establishment to clear the imported goods from customs?
d30a	To what degree is Transport an obstacle to the current operations of this establishment?
d30b	To what degree is Customs and Trade Regulation an obstacle to the current operations of this establishment?
e30	To what degree are Practices of Competitors in the Informal Sector an obstacle to the current operations of this establishment?
g2	Over the last two years, did this establishment submit an application to obtain a construction-related permit? (Y/N)
g3	In reference to that application for a construction-related permit, approximately how many days did it take to obtain it from the day of the application to the day the permit was granted?
g30a	To what degree is Access to Land an obstacle to the current operations of this establishment?
h1	From the last 3 fiscal years, did this establishment introduce any new product or service? (Y/N)
h2	From the last 3 fiscal years, did this establishment introduce any new product or service? (Y/N) also new for the establishment's main market
h5	From the last 3 fiscal years, did this establishment introduce any new or significantly improved process?
h8	In the last fiscal year, did this establishment spend on R&D (excl. market research? (Y/N)
h30	To what degree is Courts Theft and Disorder an obstacle to the current operations of this establishment?
i30	To what degree is Crime, Theft, and Disorder an obstacle to the current operations of this establishment?
j2	In a typical week over the last year, what percentage of total senior management's time was spent on dealing with requirements imposed by government regulations? (By senior management I mean managers, directors, and officers above direct supervisors of production or sales workers. Some examples of government regulations are taxes, customs, labor regulations, licensing and registration, including dealings with officials and completing forms)
j30a	To what degree is/are Tax Rates an obstacle to the current operations of this establishment?
j30b	To what degree is/are Tax Administrations an obstacle to the current operations of this establishment?
j30c	To what degree is/are Business Licensing and Permits an obstacle to the current operations of this establishment?

j30d	To what degree is/are Macroeconomic Stability an obstacle to the current operations of this establishment?
j30e	To what degree is/are Political Instability an obstacle to the current operations of this establishment?
j30f	To what degree is/are Corruption an obstacle to the current operations of this establishment?
K3a	How much of establishment working capital comes from retained earnings or internal funds (%)?
K3bc	How much of establishment working capital comes from banks (%)?
K3e	How much of establishment working capital comes from non-bank financial institutions (%)?
K3f	How much of establishment working capital comes from suppliers or customers (%)?
K3hd	How much of establishment working capital comes from friends or relatives (%)?
K6	Does this establishment have a checking or savings account? (Y/N)
K7	At this time, does this establishment have an overdraft facility? (Y/N)
K8	At this time, does this establishment have a line of credit or a loan from a financial institution? (Y/N)
K15	Approx. Collateral needed as % of the loan value/ value of the line of credit
k16	In the last fiscal year, did the establishment apply for a new loan or line of credit?
k17	What was the main reason why this establishment did not apply for any line of credit or loan?
K18	How many applications for loans or lines of credit were submitted in the last fiscal year?
K18a	Of these applications for loans or lines of credit submitted in the last fiscal year, how many of those applications were rejected?
K20	What was the most common reason given by the lender for those rejections for applications for a loan or line of credit? (7 possible answers)
k20a	Referring only to the most recent application for a line of credit or loan, what was the outcome of that application?
k30	To what degree is Access to Finance an obstacle to the current operations of this establishment?
l1	At the end of the last fiscal year, how many permanent, full-time individuals worked in this establishment? Please include all employees and managers (Permanent, full-time employees are defined as all paid employees that are contracted for a term of one or more fiscal years and/or have a guaranteed renewal of their employment contract and that work a full shift)
l2	At the end of the last 3 fiscal year, how many permanent, full-time individuals worked in this establishment?
l4a	At the end of the last fiscal year, how many permanent, full-time individuals working in this establishment were skilled/unskilled?
l4a1	At the end of the last fiscal year, how many permanent, full-time production workers were highly skilled?
l4a2	At the end of the last fiscal year, how many permanent, full-time production workers were semi-skilled?
l4b	At the end of the last fiscal year, how many permanent, full-time production workers were unskilled?
l5	At the end of the last fiscal year, how many full-time individuals working in this establishment were female?
l5a	At the end of the last fiscal year, how many full-time production workers working in this establishment were female?
l5b	At the end of the last fiscal year, how many full-time non-production workers working in this establishment were female?
l9b	What is the percentage of full-time permanent workers working in this established that completed secondary school education?
l10	In the last fiscal year, did the establishment have formal training programs for its full-time employers?
l30a	To what degree are Labor Regulations an obstacle to the current operations of this establishment?
l30b	To what degree is an Inadequately Educated Workforce an obstacle to the current operations of this establishment?
n2a	Total annual cost of labor including wages, salaries, bonuses, social security payments
n2b	Total annual costs of electricity
n2c	Total annual costs of communication
n2e	Total annual cost of raw materials and intermediate goods used in production
n2f	Total annual costs of fuel.
n2j	Other costs of production not included above
n2ra	Total rental cost of machinery, vehicles, and equipment
n2rb	Total rental cost of land and buildings
n2rb	Total rental cost of land and buildings

Note: Not all questions are available in all surveys for all countries. WEBS has a different focus on different years. These sample questions are taken from the Rwandan World Bank Enterprise Survey 2006, 2011, 2019.
Source: World Bank Enterprise Survey.

b) Caveat of the analysis

We use establishment data to provide a host of important information that is masked in aggregate data and analysis. This notwithstanding, there are some caveats in this analysis that is worth highlighting. These caveats do not in any way invalidate the analysis carried out in this report. The caveat has to do with the database we used for the analysis. In the World Bank Enterprise Survey, participating firms are asked several questions in an interview on these factors (i.e. bottlenecks) and we have to trust the responses of firms to these questions. Sometimes, the response of firms is based on opinions. Also, not every firm participating in the survey responds to every question and there is thus often a lower number of observations in terms of response rate. This usually happens when a participating firm either did not know the answer to the question being asked, the question did not apply to the firm or the firm simply did not want to answer. We must therefore keep in mind the subjective nature of some of the responses given by firms and the low number of observations in terms of the response rate to avoid over-interpreting some of the results of the analysis. The data used for the analysis, however, has been rigorously cleaned and is free from obvious mistakes and unrealistic outliers.

The second caveat relates to the industries covered in the database used for the analysis. The World Bank Enterprise Surveys do not cover certain sectors, notably the mining sector. We therefore only use manufacturing sectors and non-manufacturing sectors (excluding mining) in our analysis. Non-manufacturing sectors mainly refer to construction, transportation, wholesale and retail trade, real estate, restaurants and hotels. The high coverage of the services sector in the analysis (making up nearly the entirety of non-manufacturing industries) is very important as it highlights some of the obstacles that firms in the Rwandan service sector face given the important contribution of this sector to the country's economy as highlighted in Section 1 of this report.

Third, the analysis is purely descriptive. It does not attempt to claim causality in any part of the analysis, neither does it replace any more thorough econometric work performed on these bottlenecks, although any such exercise will also suffer from a low number of observations (per subgroup).

Finally, the industrial policy documents and the accompanying strategic intervention areas of Rwanda covers a wide range of topical issues, many of which are not covered in the World Bank Enterprise Survey that we use, despite their importance. If these intervention areas are not exhaustively covered in this report, it is attributable to data limitation and not because we value the importance of those topical issues not covered in the analysis less. Also, the most recent Rwanda World Bank Enterprise Survey was released in May 2020. This means that at the time of writing this report, not all of the results based on the surveys may necessarily reflect the most recent circumstances. Wherever possible, they have to be put into perspective using more recent, qualitative information. We have tried to reduce the extent to which this could affect our results by interviewing stakeholders in Rwanda in August and September 2020. Their views are included in the text.

c) Bottlenecks: other topics

Table A.III.7 shows the share (%) of firms that experienced water shortages, the average number of occurrences in a typical month, and average length (in hours).

Table A.III.7: Coverage of other dimensions: Water, WB Enterprise Survey

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% experienced water shortages	42.4 17.1 17.5	.	18.7	20.0	10.2	22.2	19.3	4.6	11.5	19.2	27.9	11.7
Number of water shortages	15.8 8.2 18.8	.	11.4	2.1	78.5	7.8	18.8	4.0	2.3	21.5	5.3	36.7
Length of water shortages	6.9 101.7[77] 10.6	.	17.5	15.9	14.3	2.9	10.6	2.0	17.0	9.5	11.7	9.2

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.8 shows the share (%) of firms that applied for a construction permit and the average length in days it took for completion.

Table A.III.8: Coverage of other dimensions: Construction Permit, WB Enterprise Survey

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % application	8.5 18.5 10.0	12.5	10.7	6.6	15.3	8.3	10.1	9.1	7.8	10.6	11.6	9.1
Length application	30.0 42.8 26.2	14.9	46.1	39.0	21.2	21.6	26.3	13.5	13.5	29.0	22.0	28.5

Note: Rwanda 2019 data for all columns, except Mnf and Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

[77] Data is for 2011. Breakdown numbers for domestic firms (119.8); foreign firms (11); large firms (15); SMEs (119); exporters (11); non-exporters (147); Kigali (101). Southern and Western provinces were only included in the 2019/2020 WBES.

Table A.III.9: Business-government regulation 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of time spent by managers	4.0	4.0	9.2	4.8	2.7	4.5	4.3	3.3	3.4	4.2	2.6	4.8

Note: Rwanda 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.10 shows the average days it takes for imported goods to clear customs, the share of production inputs sourced domestically and imported.

Table A.III.10: Customs and inputs sourcing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Days to clear customs[78]	16.2	7.0	16.9	16.2	.	.	12.8	21.1	3.2	19.2	12.5	19.2
Share % inputs sourced domestically	81.4	68.4	68.2	67.4	88.1	91.1	84.6	54.0	62.8	86.6	71.8	86.8
Share % inputs imported	18.6	31.6	31.8	32.9	11.8	17.7	15.3	45.9	37.1	13.3	28.1	13.1

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 and 2011 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.11 shows the share of firms that have an internet website and the share of firms that communicate with clients and suppliers through e-mail.

Table A.III.11: Digital infrastructure 2011

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of firms with an internet website	43.2	38.8	32.4	43.0	.	.	37.8	70.0	75.0	37.6	59.1	37.3
Share % firms communicating with clients and suppliers through e-mail	88.9	74.4	54.4	88.6	.	.	86.4	100.0	100.0	86.9	95.4	86.4

Note: '.' means data is not available for the indicator for the reference year. Rwanda 2011 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

[78] Data is for 2011.

Table A.III.12 shows the average wage bill (cost of labour) as a share (%) of total costs.

Table A.III.12: Share of labour costs 2006 vs. 2019

	Manufacturing	Non-manufacturing	Manufacturing - SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Wage Bill (data 2006)	24.4	46.0	NA	24.3	.	.	25.1	20.6	16.4	26.9	16.6	26.7
Wage bill (data 2019)	42.0	70.2	38.5	42.3	41.7	41.9	43.4	29.6	33.2	44.4	37.0	44.7

Note: '.' means data is not available for the indicator for the reference year. Rwanda 2006 and 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.13 lists the average share of female production and non-production workers, the average share of female business owners, and the average share of female top managers.

Table A.III.13: Role of women in manufacturing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of female production workers	21.9	.	16.8	50.0	7.6	4.1	18.0	74.2	89.0	4.0	40.8	11.5
Share % of female non-production workers	7.2	.	6.1	15.2	2.3	3.1	5.2	22.8	25.3	2.4	12.3	4.4
Share % of female owners	25.2	27.3	26.5	28.8	13.1	33.3	24.7	33.3	26.9	24.7	30.9	20.1
Share % of female top managers	14.2	22.1	12.1	8.8	15.3	19.4	13.7	13.6	23.1	11.7	18.6	11.6

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

d) Other results of the micro analysis for the groups of firms

Analysis of the Rwanda groups of enterprises (Small and Medium enterprises vs Large firms, Domestic owned vs Foreign owned, Non – exporters vs Exporters, firms in different Rwanda regions) for the overall Rwanda economy including manufacturing and services firms.

Table A.III.14. Share of firms identifying the listed factors as very severe or major bottlenecks to their business operations

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Electricity	74.6 22.2 8.3	7.9	50.1	4.9	9.1	9.1	8.5	13.1	2.7	8.8	10.6	6.8
Telecom.	15.3 13.6 .	.	15.4	.	.	.	.	.	.	.	.	.
Transportation	40.7 30.9 3.3	2.9	21.4	19.8	16.2	14.1	16.6	0	0	3.6	2.4	3.4
Customs	22.0 14.8 0.8	3.3	18.6	8.6	9.1	8.1	2.7	0	0	2.9	3.3	2.1
Informal sector	23.7 48.2 13.3	10.0	32.3	9.9	11.1	13.1	11.8	6.5	13.0	12.7	6.5	13.5
Access to land	22.0 16.1 4.2	8.8	26.5	6.8	10.1	5.1	6.0	8.7	0	8.5	6.5	7.6
Courts	15.3 6.2 0.3	0.4	11.3	2.5	3.0	3.0	0.3	0	0	0.3	0	0.4
Crime	11.9 13.6 3.3	5.0	18.3	4.3	8.1	1.0	4.5	4.4	3.7	4.6	2.4	5.5
Tax rates	49.2 14.8 10.8	9.5	28.6	11.1	18.2	7.1	10.0	8.7	3.7	11.1	6.5	11.8
Tax admin.	25.4 18.5 3.3	3.3	23.1	12.9	14.1	16.2	3.0	4.4	3.7	3.3	4.1	3.0
Business lic. and permits	6.8 6.2 0.8	0	14.5	3.1	1.0	3.0	0.3	0	0	0.3	0	0.4
Macroeconomic stability	25.4 . .	.	80.0	.	.	.	.	.	.	.	.	.
Political instability	8.5 18.5 0	0.4	25.7	0.6	3.0	1.0	1.5	0	0	0.3	0	0.4
Corruption	20.3 13.6 1.7	0	32.6	0.0	2.0	0.0	0.6	0	0	0.7	0	0.8
Access to finance	40.7 33.3 15.8	14.5	35.3	12.9	11.1	22.2	15.4	6.5	7.4	16.3	17.1	13.9
Labour regulation	13.6 9.9 2.5	1.8	10.1	1.8	4.0	0.0	2.1	0	0	2.3	2.4	1.7
Inadequately skilled labour force	13.6 29.6 7.5	3.8	16.1	22.2	14.1	24.2	4.8	4.4	3.7	5.2	4.9	5.1

Note: '.' means data is not available for the indicator for the reference year. It also means that data is not available for the industry and location for the particular indicator. A value of 0 means that no establishment or industry identify the indicator as a very severe or major bottleneck to their operations. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.15. Source of working capital 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% from retained earnings	76.3	78.5	69.5	79.2	77.8	75.7	77.2	89.1	77.8	77.7	77.6	77.8
% from banks	13.3	14.7	9.3	16.1	11.1	14.2	14.6	7.6	20.3	13.2	16.8	12.9
% from non-bank financial institutions	3.6	1.8	1.9	0.3	4.3	3.9	2.6	0.2	0.2	2.8	0.3	3.5
% from suppliers/customers	4.9	2.9	8.2	3.0	4.3	3.7	3.6	1.4	1.1	4.0	2.6	4.1
% from friends and relatives	1.6	1.9	5.5	1.2	2.1	2.5	1.8	1.5	0.5	2.1	2.4	1.5

Note: Sources of raising working capital (%) 2019. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.16: Financing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% firms with checking or savings account	92.5	94.1	84.0	96.9	82.8	98.9	93.5	100.0	100.0	92.4	99.1	90.7
% firms with overdraft facility	30.0	28.3	31.7	41.3	11.1	26.2	28.4	41.2	61.1	23.2	43.1	21.5
% firms with line of credit or loan	32.5	34.1	21.1	36.4	22.2	40.4	34.1	30.4	51.8	30.3	48.7	25.7

Note: Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey 2019.

Table A.III.17: Outcome of loan application 2006

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
No. of applications	1.3	1.8	1.5	.	.	.	1.5	1.9	2.0	1.6	2.0	1.6

No. of rejected applications	0.2	0.5	0.7	.	.	.	0.4	0.3	0.0	0.4	0.2	0.4

Note: Average number of times a firm applied for a new loan or line of credit and average number of times of rejection of financial applications. '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Mnf: Manufacturing. Rwanda 2006 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.18: Access to finance: Reasons for not applying 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
No need for loan	37.5	42.0	44.8	51.1	29.8	33.8	39.9	54.1	72.9	35.7	42.3	39.6
Application procedure were too complex	14.6	13.0	11.2	12.9	11.9	16.2	13.5	5.4	8.1	14.3	10.3	15.1
Interest rates were not favourable	9.4	6.7	16.1	8.4	7.1	6.7	6.8	13.5	8.1	7.5	9.3	6.8
Collateral requirements were too high	7.3	7.3	10.3	4.6	9.5	9.5	7.9	0	2.7	7.9	4.1	8.9
Size of loan and maturity insufficient	4.2	3.6	1.6	4.6	3.6	2.7	3.4	2.7	0	4.4	6.2	2.6
Other	21.9	20.7	8.1	15.2	26.2	25.7	21.8	24.2	8.1	23.0	25.8	18.8

Note: Share (%) of firms that responded why they did not apply for a loan. 0 means that no establishment or industry identify the indicator as a very severe or major bottleneck to their operations.. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.19: Required collateral as a share of the total value of loan/line of credit

	Mnf 2006 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Collateral needed in % of total value of loan/line of credit	166.8	261.4	320.8	276.8	270.6	262.8	272.9	287.7	284.6	267.5	257.0	284.7

Note: Collateral as a share of total value of loan/line of credit. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.20: Electricity

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Experience power outages (%)	81.4 66.7 36.7	40.0	76.3	58.0	27.0	55.0	40.8	23.9	31.5	40.2	52.0	32.1
Number of power outages	15.1 5.4 7.7	11.1	17.6	4.2	29.1	7.2	9.3	15.8	3.7	10.9	10.1	10.0
Length of power outages	4.1 6.0 0.8	1.2	8.7	0.7	2.2	1.0	1.1	0.5	0.5	1.2	0.9	1.2
Losses (%) of sales	9.2 4.9 2.0	3.1	13.3	1.9	0.2	4.4	2.9	0.3	0.8	3.1	2.5	3.0
% that own or share generator	56.9 60.5 34.2	37.9	52.5	74.0	17.0	41.0	36.3	56.5	55.6	33.3	63.4	22.8
% of electricity from own or shared generator	30.3 7.6 9.6	7.6	35.1	7.9	10.7	7.6	8.1	10.2	8.5	8.1	7.9	8.3
Cost % of electricity[79]	8.5	6.7	14.3	4.5	6.9	8.2	6.3	5.7	5.0	6.4	6.7	5.9

Note: Mnf: Manufacturing. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA.
Source: World Bank Enterprise Survey.

Table A.III.21: Average skilled and unskilled production workers, training, schooling, 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% highly skilled production workers	19.6	.	26.6	40.5	6.3	9.8	15.4	60.7	65.6	6.9	30.7	13.5
% semi-skilled production workers	13.1	.	22.5	27.2	3.9	6.6	12.6	42.8	45.7	4.1	23.8	7.1
% completed sec. school	55.6	76.5	57.7	81.4	54.3	59.0	67.7	85.2	76.5	66.6	80.8	64.2
% firm offering formal training programmes to workers	45.0	33.6	29.3	45.6	29.2	32.9	34.3	76.0	72.2	31.2	57.3	27.1

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Mnf: Manufacturing. Rwanda 2019 data for all columns except Mnf-SSA.
Source: World Bank Enterprise Survey.

[79] Share of electricity cost to total cost (%).

Table A.III.22: Coverage of other dimensions, WB Enterprise Survey

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
% experienced water shortages	42.4 17.1 17.5	.	18.7	9.0	4.0	8.0	19.3	4.6	11.5	19.2	27.9	11.7
Number of water shortages	15.8 8.2 18.8	.	11.4	2.1	78.5	7.8	18.8	4.0	2.3	21.5	5.3	36.7
Length of water shortages	6.9 101.7[80] 10.6	.	17.5	15.9	14.3	2.9	10.6	2.0	17.0	9.5	11.7	9.2

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry
Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 data for all columns, except Mnf and Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.23: Coverage of other dimensions. Construction permits. WB Enterprise Survey

	Mnf 2006 2011 2019	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % application	8.5 18.5 10.0	12.5	10.7	14.0	17.0	11.0	12.1	8.7	9.3	12.1	13.8	10.6
Length application	30.0 42.8 26.2	14.9	46.1	20.5	17.8	16.9	18.7	11.3	22.0	18.0	13.7	21.3

Note: Rwanda 2019 data for all columns, except Mnf and Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.24: Business-government regulation 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of time spent by managers	4.0	4.0	9.2	4.4	2.5	4.9	4.3	2.8	4.5	3.9	2.5	4.8

Note: Rwanda 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

[80] Data is for 2011. Breakdown numbers for domestic firms (119.8); foreign firms (11); large firms (15); SMEs (119); exporters (11); non-exporters (147); Kigali (101). Southern and Western provinces were only included in the 2019/2020 WBES.

Table A.III.25: Customs and inputs sourcing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Days to clear customs[81]	16.2	7.0	16.9	16.0	.	.	12.6	21.1	3.2	18.8	12.2	18.6
Share % inputs sourced domestically	81.4	68.4	68.2	58.6	82.5	85.9	75.0	49.1	59.6	75.1	66.7	76.1
Share % inputs imported	18.6	31.6	31.8	41.4	17.5	14.1	25.0	50.9	40.9	24.9	33.3	23.9

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 and 2011 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

Table A.III.26: Digital infrastructure 2011

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of firms with an internet website	43.2	38.8	32.4	64.2	26.3	38.4	34.8	69.2	75.7	33.8	61.5	37.8
Share % firms communicating with clients and suppliers through e-mail	88.9	74.4	54.4	81.4	.	.	76.9	94.2	97.3	75.9	96.2	77.2

Note: '.' means data is not available for the indicator for the reference year. Rwanda 2011 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey

Table A.III.27: Share of labour costs 2019

	Manufacturing	Non-manufacturing	Manufacturing - SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Wage Bill (data 2006)	24.4	46.0	.	39.4	.	.	40.7	37.2	22.2	41.5	22.7	41.7
Wage bill (data 2019)	42.0	70.2	38.5	65.9	51.6	61.5	61.4	53.0	65.3	60.0	64.2	59.1

Note: '.' means data is not available for the indicator for the reference year. Rwanda 2006 and 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

[81] Data is for 2011.

Table A.III.28: Role of women in manufacturing 2019

	Manufacturing	Non-manufacturing	Manufacturing-SSA	Kigali	Southern province	Western province	Domestically-owned firms	Foreign owned firms	Large firms	SMEs	Exporting firms	Non-exporting firms
Share % of female production workers	21.9	.	16.8	50.0	7.6	4.1	18.0	74.2	89.0	4.0	40.0	11.5
Share % of female non-production workers	7.2	.	6.1	15.2	2.3	3.1	5.2	22.8	25.3	2.4	12.3	4.4
Share % of female owners	25.2	27.3	26.5	48.0	21.0	26.0	26.4	31.8	35.8	25.0	28.7	25.5
Share % of female top managers	14.2	22.1	12.1	29.0	20.0	21.0	18.4	19.6	18.5	19.6	24.4	16.9

Note: '.' means data is not available for the indicator for the reference year. It also means data is not available for the industry and location for the particular indicator. Rwanda 2019 data for all columns, except Mnf-SSA. Mnf: Manufacturing.
Source: World Bank Enterprise Survey.

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