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# Employment creation potential, labor skills requirements and skill gaps for young people

## A Rwanda case study

**Richard Newfarmer and Anna Twum**

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**Richard Newfarmer** is the country director at the International Growth Centre for the Rwanda and Uganda programs.

**Anna Twum** is a country economist at the International Growth Centre in Rwanda.

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# Abstract

The process of structural transformation in Rwanda, like in other parts of Africa, is occurring not by relying primarily on manufacturing but instead on a diverse set of activities, including services. This prompts several questions: can Rwanda generate a sufficient number of new jobs without relying mainly on a surge in manufacturing growth to absorb increases in the labor force, especially of young workers and women? Will these new jobs be sufficiently productive to power growth and raise incomes? This paper examines the movement of workers from low-productivity activities into high-productivity activities—both *across sectors* (such as moving from agriculture to manufacturing) and *within sectors* (moving from subsistence agriculture to export and horticultural products). It finds that the most dynamic sectors of job creation are "industries without smokestacks"—tourism, business services, ICT, agro-processing, horticulture and high value-added export crops. These sectors, like manufacturing, display high average productivity, contribute a large portion of exports, and employ an ever-larger share of the labor force. The paper then creates an IWOSS-led growth scenario to 2035 to project labor demand and supply. The exercise finds that the demand for skilled labor will create a sharp market bias towards greater income inequality. A review of selected value chains in IWOSS sectors finds that a lack of skills could be one factor, among others, that could short circuit growth aspirations. Achieving sustained rapid and inclusive growth will therefore require off-setting fiscal and educational policies to reduce the skill constraints to industrial development and to mitigate the potential wage-widening effects of the skill-bias on Rwanda's growth path.

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# 1. Introduction

Young workers hold the promise of future growth in Rwanda. High, if declining, fertility rates, together with sharp reductions in child mortality, have propelled rapid increases in population and created a young labor force. In the last half-decade, the labor force has grown at just under 3 percent annually. Fully half the population is younger than 19 years. With 70 percent of the country's labor force located in rural areas, the epi-center of high fertility rates, and already with one of the highest rural densities on the continent, pressures on land are enormous. Indeed, the average farm size is roughly 0.6 hectare per person. These trends imply that Rwanda's rapidly increasing rural population will flow into cities at far lower levels of average incomes than in the historical experience of Asia and Latin America. Indeed, cities are already growing by around 4 percent annually, and the pace of urbanization is accelerating.

The economy must therefore grow rapidly—*over decades*—to create the number of jobs necessary to pull new labor into productive activities that will raise living standards. Employing young people newly streaming into the labor force into higher-productivity jobs holds the secret to raising national incomes—and achieving Rwanda's objective of becoming an upper-middle-income country by 2035.

Given Rwanda is a small landlocked country, exports, trade, and regional integration have to be drivers of future structural transformation and growth. The World Bank estimates that exports will have to grow in excess of double digits annually to achieve its income aspiration of becoming an upper-middle income country by 2035.

In the last two decades, the Rwandan economy has indeed grown rapidly; with growth in output at close to 8 percent annually since 2000, Rwanda has generally featured among the most rapidly growing economies on the continent. Rwanda's post-1994 economic growth has been characterized by a form of structural transformation in which workers have progressively moved out of agriculture but not into manufacturing (which was the pattern of growth in East Asia and today's high-income countries), but rather into services (Ggombe and Newfarmer, 2017).

This "services-first" pattern of industrial transformation prompts several questions such as: Can Rwanda generate sufficient productivity growth without relying on a surge in manufacturing to drive overall economic growth? Can it produce exports necessary to power growth, the ultimate determinant of rising average wages? Finally, can it produce a sufficient number of high-productivity jobs to raise incomes, especially those of young, women, and unskilled workers?

Indeed, the strongest growth opportunities exist in commodity-based agro-processing and services trade—what we have called "industries without smokestacks" (Newfarmer, Page, and Tarp, 2018). *A central premise for this study is that these activities can lead the structural transformation process in tandem with manufacturing growth.* Much as with traditional smokestack industries, agribusiness and food processing—two examples of "industries without smokestacks"(IWOSS)—employ unskilled and semi-skilled workers, require less physical capital per unit of output, are tradable, and exhibit high returns from the application of new technology. Moreover, many of these sectors' products are traded regionally (e.g., food products and beverages) because they are responsive to local tastes, bulky to transport, or require proximity to raw materials. Services exports, one of the IWOSS sectors, already amounting to half of Rwanda's export earnings, are central to its future and includes tourism and higher-skill services such as business process outsourcing, health care, and higher education.

This paper examines employment dynamics in Rwanda to begin to assess the potential of an IWOSS-driven economic growth path. Section 2 of this paper analyzes past patterns of growth, employment, and job creation. It focuses on movement of workers from low-productivity activities into high-productivity activities—both *across sectors* (such as moving from agriculture to manufacturing) and *within sectors* (moving from subsistence agriculture to export and horticultural products). It charts the most dynamic sectors of job creation—and finds that industries without smokestacks (IWOSS sectors) account for a major share of employment increases since 2000. These sectors, similar to manufacturing, display high average productivity, contribute a large portion of exports, and employ a relatively skilled labor force (compared to agriculture).

Section 3 creates a growth scenario built upon the government's past growth performance as well as aspirations to become a lower-middle-income country by 2035. It projects Rwanda's growth to 2035 to characterize dynamics in the labor market and the probable skills demanded.

Section 4 uses a value chain analysis to zero in on constraints to growth in select IWOSS sectors: specifically, exports and horticulture, dairy, tourism, and ICT. It analyzes impediments to export development on the demand side of the labor market and skills shortages on the supply side. The analysis shows that, without remedial policies, there is a sharp market bias towards greater income inequality.

The penultimate section reviews the Rwandan government's new policy initiatives to remove obstacles to job creation in both manufacturing and IWOSS sectors, as well as to increase the supply of skills in the labor market. A concluding section discusses the importance of policy for reducing skill constraints to industrial development and for mitigating wage-widening effects of skill bias.

# 2. Structural transformation and job creation: The past as prelude to the future

### Overview: The Rwandan labor market

According to the Rwanda National Institute for Statistics (NISR) Household Survey, of the 11.8 million Rwandans in 2017,[1] some 6.8 million were of working age (between the ages of 16 and 65). Of these, 5.9 million were economically active, and 5.8 million were employed. Some three-quarters of the labor force participated actively, and unemployed workers numbered about 100,000, amounting to an unemployment rate of around 5.3 percent according to the government's narrow definition. Youth unemployment was higher, but not dramatically so, at 7.9 percent.[2] In addition, women outnumbered men in the employed labor force by around 7 percentage points, a probable legacy of the 1994 genocide when men were disproportionately killed.

The largest share of the labor force is in agriculture--around 40 percent (excluding subsistence agriculture) and 70 percent (including subsistence agriculture). The National Institute of Statistics in Rwanda (NISR) does not include subsistence farmers in in its labor force surveys, conducted after 2016. In this study, we capture the population of subsistence farmers since we rely mostly on the household surveys that not only have more comprehensive coverage, but also date back to 2000 with three benchmark years: 2000, 2010, and 2017.

Nonetheless, some of the descriptive statistics from the narrower Labor Force Survey (LFS) are worth noting. Based on the most recent survey report for 2019, 15.2 percent of the labor force is unemployed, while 26.8 percent of employed workers face time-related underemployment. Women, the rural population, youth, and the middle-aged are more likely to be out of the labor force. In fact, women are close to 17 percentage points more likely to be unemployed than men (45 percent vs. 62 percent labor force participation), as they more frequently engage in unreported subsistence agriculture and unpaid domestic labor. The rural population is more likely to be out of the labor force than the urban population (49 percent vs. 67 percent labor participation rate), due to a higher likelihood of participation in subsistence agriculture and more limited access to job opportunities. Finally, the youth and the mature middle-aged, both having received limited education, are also less likely to be integrated into the labor force (although a significant share of youth out of the labor force are in full-time education). Underemployment is more prevalent in rural areas compared to urban ones: While rural workers experience similar unemployment to urbanites (15.2 percent vs. 15.3 percent),

1 Rwanda National Institute for Statistics Projections https://www.statistics.gov.rw/publication/rphc4-population-projections
2 As of 2016, the Rwanda National Institute for Statistics (NISR) rolled out a new Labour Force Survey (LFS) to replace employment reporting through the National Household Survey (EICV). The first pilot of the LFS was held in 2016 with surveys done every year after the conclusion of the pilot. For this paper, we use the National Household Survey to allow for a trend analysis from the period 2000-2017. Employment definitions have changed under the LFS. Overall, employment dynamics are similar across both surveys except for the definition of subsistence agriculture.

they are almost three times more likely to be underemployed (31.9 percent vs. 12 percent), due to high temporality and seasonality of agricultural employment as well as scarcity of opportunities in rural areas (RLFS, 2019).

## The future challenge: Creating jobs for an expanding population

With a current population of nearly 13 million people and an annual population growth rate of 2.1 percent, Rwanda has to create jobs at a rapid rate to absorb new workers coming into the labor force. The NISR estimates that, in the next 12 years, the working-age population will be one-third of the total population, and the urban work force will increase by more than 80 percent. This trend means, of the 2.6 million jobs that will be needed, some 1.4 million will have to be in cities (Table 1).

**Table 1: Workers will be looking for jobs in cities in the coming decade**

Working age and youth employment, 2020-2032
(thousands)

| | 2020 | 2032 | No. of additional jobs | % increase | Annual growth (%) |
|---|---|---|---|---|---|
| **Working age (16-64)** | **7,171** | **9,824** | **2,853** | **37.0** | **2.7** |
| Urban | 1,750 | 3,218 | 1,468 | 83.9 | 5.2 |
| Rural | 5,421 | 6,605 | 1,184 | 21.8 | 1.7 |
| **Youth** | **2,576** | **3,059** | **483** | **18.8** | **1.4** |
| Urban | 653 | 1,057 | 404 | 61.9 | 4.1 |
| Rural | 1,922 | 2,001 | 79 | 4.1 | 0.3 |
| **Total** | **12,663** | **16,332** | **3,669** | **29.0** | **2.1** |
| Urban | 2,773 | 4,900 | 2,127 | 76.7 | 4.9 |
| Rural | 9,890 | 11,433 | 1,543 | 15.6 | 1.2 |

Source: NISR Population Projections (2018).

Moreover, the challenge will be not in creating jobs, but in creating *good* jobs—that is, ones with progressively higher productivity. In poor countries, nearly everyone who can work does. As in other low-income countries, in Rwanda, citizens cannot rely on social insurance or transfers as they can in rich countries. In slow-growing countries with an expanding labor force, new entrants typically find work in low-productivity jobs. Whether this trend is likely to happen in Rwanda depends, in large measure, on job growth potential of the recent pattern of growth which has been increasingly driven by services and other higher-value-added sectors.

## Growth, productivity, and employment: Two decades of structural transformation

Fortunately, Rwanda's process of structural transformation has involved the movement of workers and capital into progressively higher-productivity activities—a pattern that has not followed the conventional path of agriculture to industry to services. Instead, structural transformation has involved growing employment in a host of activities that have manufacturing-like characteristics. These sectors, which Newfarmer et al. (2018) dubbed "industries without smokestacks" (IWOSS), tend to create jobs at a rate faster than subsistence agriculture, have a higher productivity, be tradable, and exhibit rapid technological change.

A look at Rwanda's employment dynamics shows that employment in IWOSS sectors has grown more rapidly than the rest of the economy. Table 2 shows the relative growth of IWOSS, manufacturing, and non-IWOSS sectors using the benchmarks of household surveys conducted in 2000 and 2016. The share of labor in subsistence agriculture has progressively declined since 2000—from 87 to 67 percent. The high employment growth sectors were agro-processing, horticulture and export agriculture, business and financial services, tourism, and construction. These sectors, which employed only 5 percent of the population in 2000, nearly more than tripled in size to 16 percent by 2017.

These trends accelerated in the 2010-2017 period. The IWOSS activities accounted for around a third of new jobs created compared to a much smaller share in the first half of the period.[3,4] Rwanda is only now beginning to develop its manufacturing sector, so the sector's contribution to employment, while growing at slightly more than twice the rate of overall employment, still amounted to only 1 percent of total employment in 2016 (Table 2).

**Table 2: IWOSS have grown more rapidly than manufacturing and other activities**

| | Employment | | | Employment share | | Annual growth |
|---|---|---|---|---|---|---|
| | 2000/2001 | 2016/2017 | Change | 2000/2001 | 2016/2017 | 2000-2017 |
| | ('000) | | | (%) | | (%) |
| **Total employment** [1,2,3] | **3,796** | **5,825** | **2,030** | **100** | **100** | **3** |
| **Total IWOSS** | **201** | **922** | **721** | **5** | **16** | **9** |
| Export crops and horticulture | 92 | 140 | 48 | 2 | 2 | 3 |
| Agro-processing | 5 | 35 | 30 | 0 | 1 | 12 |
| Construction | 26 | 255 | 229 | 1 | 4 | 14 |
| Tourism | 17 | 157 | 141 | 0 | 3 | 14 |
| ICT | - | 12 | 12 | - | 0 | - |
| Transport | 25 | 151 | 126 | 1 | 3 | 11 |
| Maintenance and repairs | 11 | 35 | 24 | 0 | 1 | 7 |
| Financial and business services | 15 | 49 | 34 | 0 | 1 | 7 |
| Trade (excl. tourism): formal | 10 | 86 | 76 | 0 | 1 | 13 |
| **Manufacturing (excl. agro-processing)** | **25** | **85** | **60** | **1** | **1** | **7** |
| **Other non-IWOSS** [4,5] | **3,569** | **4,818** | **1,249** | **94** | **83** | **2** |
| Agriculture | 3,296 | 3,926 | 630 | 87 | 67 | 1 |
| Mining | 6 | 51 | 45 | 0 | 1 | 13 |
| Utilities | 4 | 11 | 6 | 0 | 0 | 5 |
| Trade (excl. tourism) informal | 82 | 296 | 215 | 2 | 5 | 8 |
| Domestic services | 82 | 239 | 157 | 2 | 4 | 7 |
| Government | 71 | 202 | 130 | 2 | 3 | 6 |
| Other | 28 | 94 | 66 | 1 | 2 | 7 |

Source: Authors' calculations using Rwanda National Institute of Statistics Integrated Household Survey: EICV1, EICV3, EICV4.
Notes: 1. Numbers might not match published reports. Details of adjustments are not available for replication. 2. Working-age population is defined as 16 years and over by the NISR. 3. Employment for "export crops and horticulture" and "tourism" are estimated using IFPRI (2017). Employment for ICT is not reported in 2000. 4. Agriculture includes subsistence agriculture. 5. Employment in trade (formal and informal) is estimated using ratios of employment from the Rwanda Establishment Census.

## Out of agriculture into higher labor productivity activities

Shifts out of agriculture have transformed the structure of the economy. Labor productivity in agriculture—outside of horticulture and export crops, such as coffee, tea, and pyrethrum—has remained low, and so workers have migrated to other activities where they could find better jobs. In 2017, labor productivity in subsistence agriculture was around RWF 0.42 million (about $500) per worker, only one-fifth of the levels in the IWOSS and manufacturing sectors.

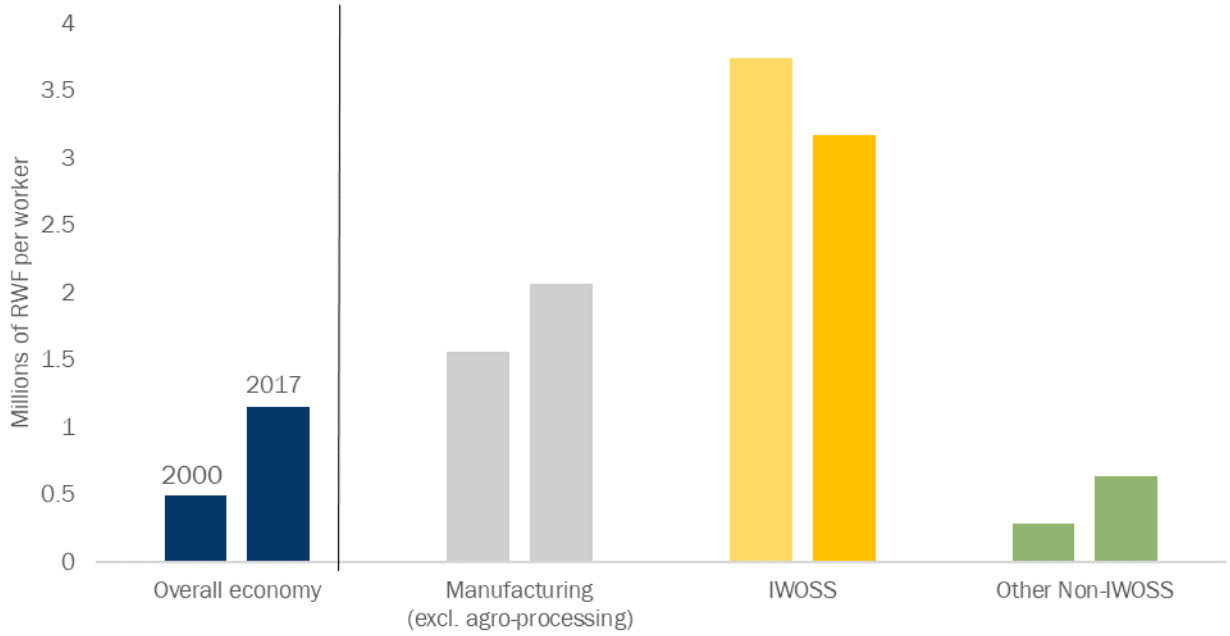
IWOSS sectors are around twice as productive as the economy as a whole (Figure 1). In 2017, labor productivity, defined as value added per worker, in the IWOSS sectors was relatively close to that of

3 For detail, see Annex Table 2 Labor Productivity by Sector. Some of the disaggregated lines are likely to involve statistical error simply because data collection tended to improve with each household survey. For these reasons, sub sectoral trends in the second half of the period are likely to be more reliable than the first.
4 Our IWOSS classification is based on the International Standard Industrial Classification of All Economic Activities (ISIC), which sets international standards for how to categorize economic activities within an economy. By design, the ISIC structure allows for more detailed categorizations of economic activity. Most of our sectors are directly mapped onto ISIC sections (Tables A3); adjustments are made to more precisely estimate agro processing, exports and horticulture, repairs, domestic services and trade. Adjustments for each sector are detailed in table A3. Agro processing mainly consists of food and beverage production using ISIC group level under divisions 10-33. Similarly, the classification for repairs and domestic services is established at the ISIC group level under divisions 45-47, 94-96 and 97-98.

manufacturing and more than five times the productivity of "non-IWOSS" sectors. The reduction in employment share for non-IWOSS sectors is mostly from the reduction in the share of workers in agriculture. However, subsistence agriculture continues to be a major employer, followed by informal trade and the domestic services sector—a largely informal sector employing around the same number of workers as the construction sector (Table 2).

The IWOSS sectors have labor productivity levels comparable to manufacturing, RWF 3.4 million per worker, compared to RWF 2.1 million. Within the IWOSS grouping, the highest productivity levels are found in financial and business services, ICT, and agro-processing. Horticulture and formal trade are not as high, but even these sectors have labor productivity levels that surpass those of non-commercial agriculture. IWOSS activities are not the only high-productivity areas of employment: For example, mining, utilities, government, and "other" all present higher labor productivity than non-commercial agriculture.[5]

**Figure 1: Labor productivity for IWOSS, like manufacturing, is higher than vs non-IWOSS**




Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National Accounts.

## Structural change has been growth-enhancing

As workers have moved out of non-commercial agriculture into higher productivity activities, the economy has grown at rates of around 8 percent annually. However, Rwanda has experienced some volatility in growth rates, mainly because of weather-induced fluctuations in agricultural production in the 2000-2016 period. Nonetheless, the extent of structural transformation has been impressive (Figure 2).

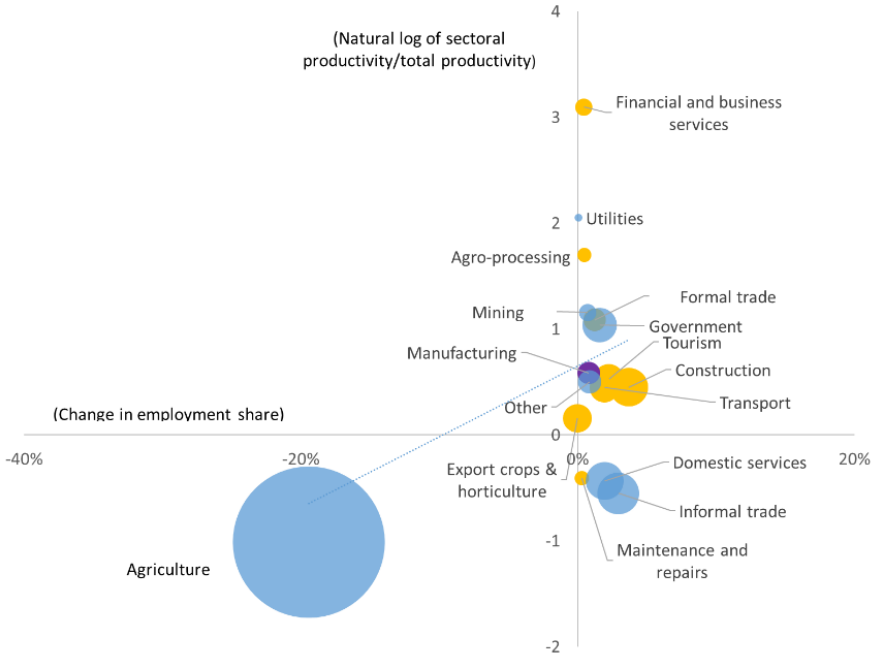
The size of the bubbles in Figure 2 corresponds to the size of sectoral employment in 2017, and the quadrants show low-productivity sectors with declining employment on the left lower quadrant contrasted with high-productivity, increasing employment sectors in the top right quadrant. The upward sloping regression line reveals that structural transformation has been sharply positive. The *yellow* bubbles indicate the IWOSS sectors, *purple* is manufacturing, and *light blue* are the other non-IWOSS activities. While workers in manufacturing have relatively high productivity compared to those in

5 "Other" is a mishmash of activities, ranging from "domestic services" (roughly half the employment) to "repairs and maintenance," and "personal services" such as hair dressing.

traditional agriculture, the IWOSS sectors collectively employ many more people. In effect, they have played a far more important role in the growth process of Rwanda than manufacturing has to date.

**Figure 2: Changes in share of employment and movement into higher productivity sectors, 2000-2017**

*Labor is moving into higher productivity activities, led by IWOSS*




Source: Authors' calculations using EICV3, EICV5 and Rwanda National Accounts. Size of bubbles equal employment share in 2017.

As workers have moved from subsistence agriculture into other activities, labor productivity in agriculture has risen somewhat with fewer workers associated with the same or rising production. Correspondingly, labor productivity rates fell slightly over the 2010-2016 period with the entry of additional workers, evident in trends for agro-processing, tourism, transport, and formal trade. Still, the sectors that are gaining workers have a higher productivity than subsistence agriculture.

## Growth creates jobs

Between 2000 and 2017, growth in value added of the IWOSS sectors resulted in more jobs than value-added growth in non-IWOSS sectors, including manufacturing. Sectoral employment elasticity measures-a measure of the responsiveness of employment to value-added growth- provide another way to measure job creation and labor intensity. Using value added and employment estimates from 2000 and 2017, we estimate an economy-wide employment elasticity of 0.21.[6] The lowest elasticity—estimated to be about 0.17—is observed in the non-IWOSS sectors excluding manufacturing (Table 3). Notably, the IWOSS sectors show employment elasticities close to double that of the manufacturing sector, indicating that the growth in IWOSS sectors has translated into stronger employment growth relative to other sectors (Table 3). In short, IWOSS has increased its value added by 278 percent and increased its share of employment by 358 percent.

6 Formula used to calculate employment elasticity:

$$emp\_elasticity_{s(t)} = \frac{\%\Delta\ labour_{s(\ t,t-1)}}{\%\Delta\ GDP_{s(t,t-1)}}$$

$emp\_elasticity_{s(t)}$ = Estimates employment elasticity for sector s in period t; $labour_{s(t)}$ = Labor force of sector s in period t; $GDP_{s(t)}$ = GDP of sector s in period t; s=sector (agro-processing, tourism, utilities…); t=period

Not only have IWOSS sectors been strong drivers of growth, they have also intensely created jobs for women and young people in particular. Compared to non-IWOSS and manufacturing, IWOSS sectors have an elasticity of 1.26, significantly higher than the elasticity for the overall economy of 0.04 and around double that of manufacturing, which is around 0.56. We observe a similar trend for youth employment: Once again, IWOSS emerges as a strong generator of jobs for the youth, followed by non-IWOSS sectors and the manufacturing sector. These findings position IWOSS sectors as an important tool for government policy aimed at boosting employment for women and the youth.

**Table 3: Growth and jobs: A sectoral perspective**

| | 2000-2017 | | | | 2010-2017 |
|---|---|---|---|---|---|
| Sector | Change in GDP (%) | Change in employment (%) | Employment elasticity | Women employment elasticity | Youth employment elasticity |
| **Total IWOSS** | **278** | **358** | **1.10** | **1.26** | **0.28** |
| Export crops and horticulture | 118 | 52 | 0.44 | 5.87 | 0.15 |
| Agro-processing | 181 | 618 | 3.41 | 3.92 | 1.95 |
| Construction | 494 | 879 | 1.78 | 0.42 | 0.24 |
| Tourism | 707 | 839 | 1.19 | 0.81 | 0.18 |
| ICT | - | - | - | - | - |
| Transport | 642 | 501 | 0.78 | -0.08 | 0.05 |
| Maintenance and repairs | 335 | 217 | 0.65 | -0.03 | 0.54 |
| Financial and business services | 181 | 220 | 1.22 | 0.32 | 0.24 |
| Trade (excl. tourism): formal | 387 | 755 | 1.95 | 1.95 | 0.14 |
| **Manufacturing (excl. agro-processing)** | **350** | **240** | **0.69** | **0.56** | **-0.13** |
| **Other non-IWOSS** | **206** | **35** | **0.18** | **0.01** | **0.07** |
| Agriculture | 145 | 19 | 0.13 | -0.03 | 0.06 |
| Mining | 541 | 752 | 1.39 | 0.09 | -0.01 |
| Utilities | 24 | 143 | 5.85 | -3.85 | 0.33 |
| Trade (excl. tourism) informal | 387 | 262 | 0.68 | 0.68 | 0.21 |
| Domestic services | 644 | 193 | 0.30 | 0.21 | 0.06 |
| Government | 311 | 182 | 0.59 | 0.30 | -0.15 |
| Other | 644 | 231 | 0.36 | 0.15 | -0.08 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National Accounts.
Notes: 1. Employment elasticity is defined measures the growth of employment relative to the growth of the economy. 2. Value added is approximated for sectors not directly reported in the national accounts. See Annex A. 3. For export crops and horticulture, value added is estimated using IFPRI (2017). See Annex A. 4. Employment numbers for ICT are not reported in 2000. Employment elasticity for 2010-2017 is 0.93. 5. Youth employment elasticities are calculated for 2010-2017 because of issues verifying the youth employment number for 2000.

Growth in IWOSS sector exports have outpaced growth in non-IWOSS sectors with the strongest growth coming from tourism, horticulture, and agro-processing. Table 4 breaks down export revenues revealing a reliance of the economy on exports from IWOSS sectors: 60 and 61 percent of total formal exports in 2011 and 2017, respectively, with a majority of these exports concentrated in services and coffee and tea. Non-IWOSS sectors, mainly manufacturing (excluding agro-processing), government services, and mining made up around 38 and 42 percent of formal exports in 2011 and 2017 but grew slower or at around the same pace as IWOSS sectors.

**Table 4: IWOSS exports have powered Rwandan growth in the last decade**

| Sector | 2011 | | 2017 | | 2011-2017 |
|---|---|---|---|---|---|
| | USD million | Share (%) | USD million | Share (%) | Annual % growth |
| **IWOSS** | **552** | **60** | **1255** | **61** | **15** |
| **IWOSS services exports[1]** | 392 | 43 | 943 | 46 | 16 |
| Transport | 51 | 6 | 194 | 9 | 25 |
| Tourism | 252 | 27 | 438 | 21 | 10 |
| Telecommunication | 53 | 6 | 19 | 1 | -16 |
| Re-exports | 37 | 4 | 292 | 14 | 41 |
| **IWOSS goods exports** | 160 | 17 | 311 | 15 | 12 |
| Horticulture | 3 | 0 | 16 | 1 | 32 |
| Coffee and tea | 130 | 14 | 154 | 8 | 3 |
| Other agricultural products | 6 | 1 | 8 | 0 | 4 |
| Agro-processing | 21 | 2 | 60 | 3 | 19 |
| **Manufacturing** | **46** | **5** | **58** | **3** | **4** |
| Light manufacturing | 6 | 1 | 14 | 1 | 17 |
| Textiles | 13 | 1 | 14 | 1 | 1 |
| Other manufacturing | 27 | 3 | 30 | 1 | 2 |
| **Non-IWOSS** | **323** | **35** | **740** | **36** | **15** |
| Mining | 165 | 18 | 392 | 19 | 16 |
| Government and other services | 158 | 17 | 348 | 17 | 14 |
| **Total exports (goods and services)** | **922** | **100** | **2053** | **100** | **14** |

Source: Author's calculations from ASYCUDA data does not include adjustments from export surveys.
Notes: 1. BNR EBOPS statement (2017).

## IWOSS demands greater skills[7]

Although IWOSS sectors are relatively more skill-intensive than non-IWOSS sectors, they also emerge as significant employers of low-skilled labor, employing nearly 13 percent of the 4.8 million low-skilled workers in 2017 (Table 5) compared to the 1.3 percent employed in manufacturing. About 26 percent of workers in IWOSS are either high-skilled (5 percent) or medium-skilled workers (21 percent) with the financial and business services and ICT sectors emerging as the most skill-intensive of the IWOSS sectors. IWOSS sectors with the highest share of low-skilled workers are formal trade, export crops, horticulture, and maintenance and repairs (Table 5). The skill breakdown of IWOSS sectors more or less parallels the skill distribution in the manufacturing sectors. On the other hand, non-IWOSS sectors are more low skill-intensive with only 16 percent of workers falling in the high-skilled and skilled categories; government and utilities sectors are exceptions with most workers considered skilled and high skilled, around 80 and 65 percent, respectively.

7 This paper defines skill using educational attainment as a proxy. High skilled are workers that have at least some tertiary education; medium skilled workers are those that have complete primary and have some secondary education; and low skilled have some primary or no formal education (See Annex A on methodology).

**Table 5. Breakdown of sectoral employment by skill level, 2017**

| | Absolute | | | Share | | |
|---|---|---|---|---|---|---|
| | High skilled | Skilled | Low skilled | High skilled | Skilled | Low skilled |
| | ('000) | | | (%) | | |
| **Total employment** | **157** | **760** | **4,827** | **3** | **13** | **84** |
| **Total IWOSS** | **37** | **177** | **628** | **4** | **21** | **75** |
| Export crops and horticulture | 1 | 16 | 141 | 0 | 10 | 90 |
| Agro-processing | 2 | 8 | 26 | 5 | 21 | 74 |
| Construction | 9 | 59 | 187 | 3 | 23 | 73 |
| Tourism | 6 | 25 | 29 | 9 | 42 | 48 |
| ICT | 4 | 5 | 3 | 33 | 43 | 24 |
| Transport | 4 | 37 | 111 | 3 | 24 | 73 |
| Maintenance and repairs | 1 | 7 | 28 | 2 | 19 | 80 |
| Financial and business services | 11 | 18 | 20 | 23 | 36 | 41 |
| Trade (excl. tourism): formal | 1 | 3 | 82 | 1 | 4 | 95 |
| **Manufacturing (excl. agro-processing)** | **2** | **19** | **63** | **3** | **23** | **74** |
| **Other non-IWOSS** | **117** | **563** | **4,137** | **2** | **12** | **86** |
| Agriculture | 13 | 389 | 3,523 | 0 | 10 | 90 |
| Mining | 0 | 5 | 46 | 0 | 9 | 91 |
| Utilities | 2 | 5 | 4 | 14 | 51 | 35 |
| Trade (excl. tourism) informal | 0 | 13 | 284 | 0 | 4 | 96 |
| Domestic services | 2 | 38 | 199 | 1 | 16 | 83 |
| Government | 79 | 84 | 38 | 39 | 42 | 19 |
| Other | 21 | 30 | 43 | 23 | 32 | 45 |

Source: Authors' calculations using EICV1, EICV3, EICV5.
Notes: 1. Totals of sectors by skill level do not match totals presented in Table 1 because of missing information on education. 2. High skilled=post-secondary education; skilled= secondary education; low skilled=lower than secondary education.

# 3. Scenarios for the future: Emerging demand for skilled workers

What does the future hold? This section presents a "business-as-usual" scenario to estimate the labor demand and skill distribution of the labor force in 2035 if the economy maintains an average annual growth rate of 8 percent, similar to its past performance. The government, working with the World Bank, put together an aspirational growth scenario, calibrated so that Rwanda could become an upper-middle-income country by 2035. It is indeed aspirational in that the scenario entails historically high growth rates roughly equivalent to those China experienced after its 1978 reforms—between 10 to 12 percent annual growth rate in GDP. Under the scenario, we look at how employment trends evolve for IWOSS, manufacturing, and non-IWOSS sectors along with changes to sectoral skill distribution.

GDP estimates for IWOSS and non-IWOSS sectors are projected by decomposing an overall economic growth rate of 8 percent to growth rates at the sectoral level based on past performance and projection from the Ministry of Finance. Using the employment shares and elasticities emerging from the two recent household surveys (2010/11 and 2016/17) as parameters for the aggregates, we project employment growth to 2035 based on the projected growth of IWOSS and other sectors to construct a sectoral distribution of employment in 2035 based labor force projections from the government (Table 6).[8]

8 First, instead of linearly projecting GDP from historical GDP, we project GDP in line with existing economic growth targets from the government and labor force projections by the national statistics agency. Second, we project labor demand using adjusted employment elasticities and bound demand by the projected size of the working age population in 2035. Third, we project skill distribution by sector using the trend in changes in skill distribution between 2010 and 2017.

### Table 6: A growth scenario to 2035: Projected GDP at 8 percent and labor demand in 2035

| | GDP | | | Employment | | | | Share of total employment | |
|---|---|---|---|---|---|---|---|---|---|
| | 2017 | 2035 (proj) | Annual growth | 2017 | 2035 (proj) | Add. jobs | Annual growth | 2017 | 2035 (proj) |
| | RWF billions | RWF billions | (%) | ('000) | ('000) | ('000) | (%) | (%) | |
| **Overall economy** | **6,692** | **26,642** | **8** | **5,825** | **9,825** | **3,999** | **3** | **100** | **100** |
| **Total IWOSS** | **3,139** | **16,099** | **10** | **922** | **3,463** | **2,541** | **8** | **16** | **35** |
| Export crops and horticulture | 188 | 754 | 8 | 140 | 500 | 360 | 7 | 2 | 5 |
| Agro-processing | 222 | 1,443 | 11 | 35 | 240 | 204 | 11 | 1 | 2 |
| Construction: formal and informal | 460 | 2,160 | 9 | 255 | 901 | 646 | 7 | 4 | 9 |
| Tourism | 306 | 2,001 | 11 | 157 | 685 | 527 | 9 | 3 | 7 |
| ICT | 115 | 1,037 | 13 | 12 | 100 | 88 | 12 | 0 | 1 |
| Transport | 272 | 1,282 | 9 | 151 | 486 | 335 | 7 | 3 | 5 |
| Maintenance and repairs | 27 | 65 | 5 | 35 | 63 | 27 | 3 | 1 | 1 |
| Financial and business services | 1,254 | 5,955 | 9 | 49 | 209 | 160 | 8 | 1 | 2 |
| Trade (excl. tourism): formal | 295 | 1,401 | 9 | 86 | 280 | 194 | 7 | 1 | 3 |
| **Manufacturing (excl. agro-processing)** | **175** | **1,118** | **11** | **85** | **442** | **358** | **10** | **1** | **5** |
| **Other non-IWOSS** | **3,125** | **9,426** | **6** | **4,818** | **5,919** | **1,100** | **1** | **83** | **60** |
| Agriculture | 1,639 | 3,713 | 5 | 3,926 | 4,391 | 465 | 1 | 67 | 45 |
| Mining | 186 | 1,036 | 10 | 51 | 139 | 88 | 6 | 1 | 1 |
| Utilities | 95 | 529 | 10 | 11 | 16 | 5 | 2 | 0 | 0 |
| Trade (excl. tourism) informal | 196 | 648 | 7 | 296 | 478 | 181 | 3 | 5 | 5 |
| Domestic services | 178 | 990 | 10 | 239 | 408 | 169 | 3 | 4 | 4 |
| Government | 653 | 1,570 | 5 | 202 | 332 | 130 | 3 | 3 | 3 |
| Other | 178 | 938 | 10 | 94 | 156 | 62 | 3 | 2 | 2 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National accounts.
Notes: 1. Methodology for GDP projections for 2035 are detailed in Annex A. 2. Employment projections a based on projected employment elasticities and GDP in 2035.

This pattern of growth would most certainly create a strong demand for labor—especially skilled labor (Table 7). The demand for high-skilled workers would outpace the growth of even moderately skilled workers as well as the demand for low-skilled workers. The IWOSS sectors, together with manufacturing, are main drivers of this process. We rely on the trend of skill change for different sectors between the 2010 and 2017 Household Surveys to project the sectoral skill demand in 2035. Since these estimates are not bounded by the size of the labor force, we take the skill distribution of the extra jobs created between 2017 and 2035 (based on 2000-2017 trends) and apply those distributions to our bounded estimates of additional labor demanded in 2035.[9]

This methodology is sensitive to the fact that future employment (which equals labor demand in our scenario) is a combination of a stock of existing workers whose skills distribution will not change on average and a flow of new workers that will add to the skill pool. Table 7 summarizes our estimated skill distribution for 2035. Similar to our previous tables, the definition of skill is based on education level: High-skilled workers are those with post-secondary education; skilled workers have either completed secondary school or at least have some years of secondary education; and unskilled workers have less than a secondary education or no formal education whatsoever.

In 2017, workers were predominantly low-skilled, and IWOSS sectors were relatively more skill-intensive than manufacturing and other non-IWOSS sectors. In 2035, we estimate a shift not only in the overall skill distribution of workers in the overall economy but also within IWOSS and non-IWOSS sectors. Across the board, there is an upskilling of the labor pool with the number of skilled jobs highest in IWOSS sectors.[10]

Can Rwanda satisfy this demand for high-skilled and moderately skilled workers? Based on an academic study,[11] the *Future Drivers of Growth* Study by the Government of Rwanda and World Bank put together a business-as-usual scenario for labor supply in 2035: In it, 6 percent of supply will consist of high-skilled workers, 34 percent skilled workers, and 60 percent low-skilled workers. Juxtaposing the anticipated supply with the anticipated demand in Table 7 reveals looming gap in skills that might well develop over the next decade and one half. The shortage could exceed 3 percent of the demand if the government does not make a jump shift in its workers' skill development (Table 8).

Before exploring ways the government could remedy this deficit, the subject of the final section, it is helpful to drill down into specific value chains to understand constraints to IWOSS development.

9 To project the skill breakdown of labor supply in 2035, we use skill projections from a joint country study by the Government of Rwanda-The Future Drivers of Growth Report (2018) - and the World Bank. Under a "business-as-usual scenario," 5 percent of the labor supply in 2035 will be high skilled, 35 percent will be skilled, and the remaining 60 percent will be low skilled. The numbers are estimated on the current growth rate of school enrollment.

10 We estimate the breakdown of projected labor force for each sector by high skilled, skilled, and low skilled using the estimation below:

$$labour_{sv(2035)} = labour_{sv(2017)} + \left(\left(labour_{s(2035)} - labour_{s(2017)}\right) * shr\_labour_{sv(2017)}\right)$$

s= sector (agro-processing, tourism, utilities…) v= high skilled, skilled, low skilled

$labor_{sv(2035)}$= Projected labor force of sector s in 2035 by skill level v; $labor_{sv(2017)}$= Projected labor force of sector s in 2017 by skill level v; $shr\_labor_{sv(2017)}$= Share of difference between sector s labor force in 2017 and 2010 by skill level v.

11 Based on Lutz, Butz, and KC, 2014.

### Table 7: The jobs of the future will require greater skills

Projected labor demand by skill level

| | 2017 | | | 2035 (proj) | | | | | | Annual % growth 2017-2035 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | High skilled | Skilled | Low skilled | High skilled | Skilled | Low skilled | High skilled | Skilled | Low skilled | High skilled | Skilled | Low skilled |
| | (%) | | | ('000) | | | (%) | | | (%) | | |
| **Total employment** | **3** | **13** | **84** | **507** | **3,709** | **5,609** | **5** | **38** | **57** | **7** | **9** | **1** |
| **Total IWOSS** | **4** | **21** | **75** | **229** | **2,205** | **1,030** | **7** | **64** | **30** | **11** | **15** | **3** |
| Export crops and horticulture | 0 | 10 | 90 | 7 | 296 | 197 | 1 | 59 | 39 | 15 | 18 | 2 |
| Agro-processing | 10 | 69 | 21 | 3 | 122 | 115 | 1 | 51 | 48 | 4 | 17 | 9 |
| Construction | 3 | 23 | 73 | 26 | 683 | 192 | 3 | 76 | 21 | 6 | 15 | 0 |
| Tourism | 9 | 42 | 48 | 68 | 546 | 71 | 10 | 80 | 10 | 9 | 12 | 0 |
| ICT | 33 | 43 | 24 | 18 | 80 | 3 | 17 | 80 | 3 | 8 | 16 | -1 |
| Transport | 3 | 24 | 73 | 61 | 301 | 124 | 12 | 62 | 25 | 17 | 12 | 1 |
| Maintenance and repairs | 2 | 19 | 80 | 1 | 24 | 38 | 1 | 38 | 61 | 0 | 7 | 2 |
| Financial and business services | 23 | 36 | 41 | 43 | 135 | 31 | 21 | 65 | 15 | 8 | 12 | 2 |
| Trade (excl. tourism): formal | 1 | 4 | 95 | 3 | 17 | 260 | 1 | 6 | 93 | 7 | 9 | 7 |
| **Manufacturing (excl. agro-processing)** | **3** | **23** | **74** | **20** | **145** | **278** | **5** | **33** | **63** | **13** | **12** | **9** |
| **Other non-IWOSS** | **2** | **12** | **86** | **258** | **1,359** | **4,301** | **4** | **23** | **73** | **4** | **5** | **0** |
| Agriculture | 0 | 10 | 90 | 13 | 854 | 3,524 | 0 | 19 | 80 | 0 | 4 | 0 |
| Mining | 0 | 9 | 91 | 0 | 93 | 45 | 0 | 67 | 33 | 0 | 18 | 0 |
| Utilities | 14 | 51 | 35 | 2 | 11 | 4 | 11 | 66 | 22 | 1 | 4 | 0 |
| Trade (excl. tourism) informal | 0 | 4 | 96 | 0 | 21 | 457 | 0 | 4 | 96 | - | -1 | 3 |
| Domestic services | 1 | 16 | 83 | 2 | 205 | 201 | 0 | 50 | 49 | 1 | 10 | 0 |
| Government | 39 | 42 | 19 | 175 | 128 | 29 | 53 | 39 | 9 | 4 | 2 | -2 |
| Other | 23 | 32 | 45 | 66 | 47 | 43 | 42 | 30 | 28 | 6 | 3 | 0 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National accounts. 2035 estimates are projected.
Notes:
1/ Skill breakdown for 2035 is based on skill distribution in 2017 from EICV5.
2/ Adjusted estimates for tourism are distributed using skill distribution in EICV5.
3/ Informal trade is assumed to be fully skilled and low skilled in 2035.

**Table 8: Projected skills deficit, 2035**

| | High skilled | Skilled | Low skilled |
|---|---|---|---|
| | | ('000) | |
| **Projected labor supply (World Bank) High growth scenario: 8% annual growth rate** | **491** | **3,340** | **5,993** |
| Projected labor demand | 507 | 3,709 | 5,609 |
| Skill gap | 16 | 368 | -384 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National accounts. 2035 estimates are projected.
Notes: 1/ Skill breakdown for 2035 is based on skill distribution in 2017 from EICV5. Adjusted estimates for tourism and trade are distributed using skill distribution in EICV5. 2/ Labor supply by skill in 2035 is projected using WBG (2018). Figure 0.19: 5% tertiary, 35% some secondary, 60% less than secondary.

# 4. Value chains for IWOSS subsectors: Potential, problems, and policy[12]

To drill down on ways growth in the IWOSS sectors will ripple through the economy, it is helpful to focus on several economically strategic value chains. As with manufacturing, the IWOSS sectors have large direct and indirect effects on employment creation. High-productivity export crops and horticulture, agro-industry, tourism, and ICT are particularly dynamic.

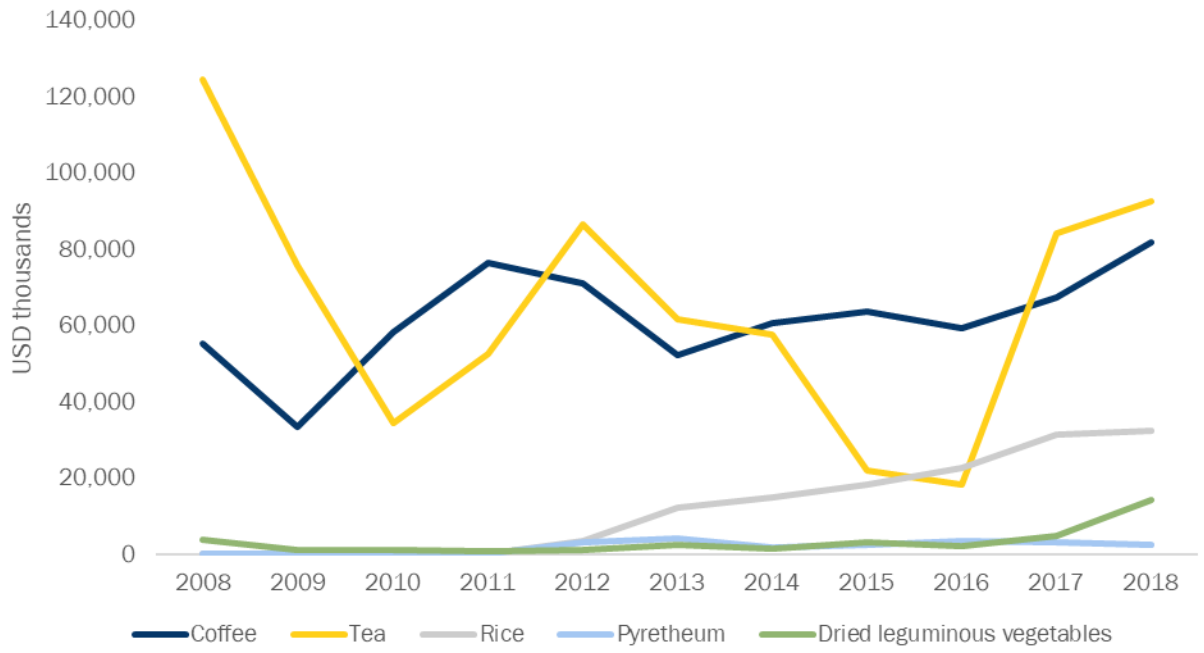
In 2017, these activities accounted for around 345,000 workers, a number that is four times the employment in manufacturing. As labor is released from agriculture in coming years, these subsectors, along with IWOSS activities in general, will become more important sources of jobs for young people and women entering the labor market. Using an employment elasticity approach together with realistic assumptions for GDP growth, it is likely these four IWOSS subsectors will employ more than five times that of manufacturing by 2035. This section elaborates on value chains associated with these subsectors to explore some of the obstacles to their growth that require policy attention.

## Export crops and horticulture

Export agriculture and horticulture in 2017 employed about 140,000 workers and is likely to employ many new workers over the next decade, perhaps growing threefold by 2035. Between 2013 and 2018, export revenues from agricultural crops more than doubled from around $225 million to $516 million (NAEB, 2019). Within the export sector, tea and coffee still dominate, though other traditional exports-pyrethrum, wheat and maize flour- and newer export products, including stevia, essential oils and hides, are increasing as a share of export revenues (Figure 3). Regional markets account for a large share of export crops and low-value horticulture while the EU and Asia market have been a growing market for high-value horticulture like flowers and chilis. Each of these commercial products—and their respective value chains—have been the subject of extensive analyses, and the government has developed sophisticated policy approaches for each.[13]

12 This section draws on Ggombe and Newfarmer (2018), Spray and Agarwal (2016), Gereffi et al (2017a, 2017b), and Murray and Wolf (2017).
13 On coffee, see, for example, Ameet Morjaria (2017).

**Figure 3: Coffee and tea are still the most important export crops**




Source: International Trade Centre Trade Statistics.

The National Export Strategy (2010-2015) highlighted export diversification as a key priority, focusing on several non-traditional sub-sectors, including horticulture. Horticultural products have increased in economic importance, nearly doubling in tonnage between 2008 and 2012 (World Bank, 2015), with further increases between 2012 and 2020.

The government aims to double revenue from regional and international exports of agricultural crops—traditional and non-traditional—by 2024. To do so will require improvements in the promotion of export crops in key markets; sustained increases in private sector investments; continuous commitment to quality production and productivity; and cost-competitive air and sea freight and ground logistics for exports in strategic value chains (NAEB, 2019). Together with broad policy objectives for the sector, the government has also identified priority values chains to drive future growth: horticulture (primarily French beans, macadamia nuts, pyrethrum, and cut flowers), essential oils, stevia, and the traditional crops of tea, coffee, and cereals.

Horticulture is primed for exponential growth. Indeed, the six months of rainfall annually is ideal for horticulture farming; the wet and cool climate in the high-altitude north and west are convenient for temperate fruits, big-headed roses, and herbs; and avocados, beans, chilis, and Asian vegetables thrive in the sunny and warm south and east.[14] Over the past decade, there has been a steady increase in the number of horticulture exporters in the country owing to improvements in productivity, market access, and standards. Indeed, export revenues from horticulture have doubled from around $10 million in 2013/2014 to around $23 million in 2017/2018 ( NAEB 2019). However, limited land for expansion and inadequate knowledge on proper crop cultivation, fertilizer use, pest management, post-harvest handling, and export procedures continue to plague the horticulture sector. One potential growth area for horticulture is organic farming; organic produce attracts a higher price in export markets driven by evolving customer preference for healthy and environmentally safe produce.

14 This section is adapted from Ggombe and Newfarmer (2018).

However, the high cost of obtaining an organic license means that majority of horticulture farmers are not licensed organic farmers.

Other challenges to the sector include low productivity augmented by a gap in the knowledge and skill required to cultivate high-yield varieties, low access to and high cost of inputs in the sector, and non-existent or inadequate quality management and low market access. The government has stepped up efforts to train farmers on agricultural and agronomic practices through various government and private initiatives. Farmer schools and extension services have been effective in upskilling farmers. In addition, the supply of inputs have been improved through the One Acre Fund, a private initiative that provides financing to farmers for timely access to inputs. It is also worth noting the role of private sector investment in increasing capacity and support for greater market access. Notably, reducing the costs of airfreight between Kigali and international markets, which are among the highest in the region, could further maximize revenues from horticulture. With airfreight costs substantially reduced, Rwanda will be in a position to serve the increasing demand for fresh fruits and vegetables in the East African Community (EAC) and the Democratic Republic of the Congo.

Beyond these efforts, the government has committed to horticultural development through: earmarking sites for horticultural cultivation; investing in agricultural land information systems and irrigation facilities; developing a cold chain system, including a Kigali pack house; setting up a modern cold storage facilities at Kigali International Airport; improving feeder roads, electricity supply and reliability, and air connectivity to horticulture production areas; and providing prospective exporters with access to subsidized finance through an export growth facility. There are also initiatives to improve access to finance, notably through the export growth facility managed by Rwanda Development Bank (BRD). Tax incentives and investment aftercare services are also key investment facilitation strategies for the sector. These initiatives require focused public and private investment and close collaboration with producers in the sector.

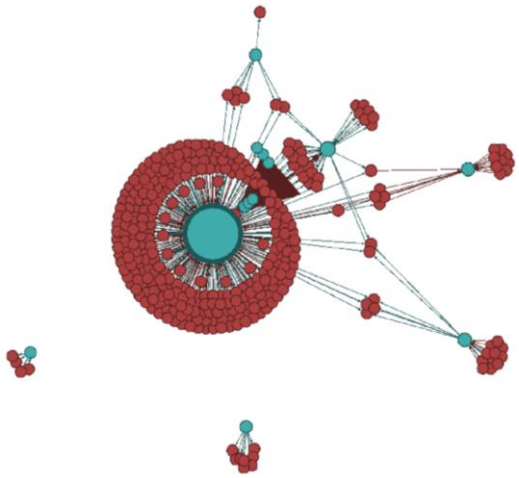
### Agro-processing: The case of dairy

Agro-processing is an industry where Rwanda has a natural comparative advantage. Agro-processing uses perishable produce to convert to processed foods such as corn and wheat flour, bread, biscuits, dairy, and beverages, such as milk and juices. Some of these products, such as biscuits, are differentiated consumer goods. Moreover, Rwandan producers enjoy unique access to the large (if low-income) populace in the DRC. In 2017, this sector employed around 35,000 workers, and if it is to absorb 2035 projected labor force for the sector, it needs to grow by around 8 percent annually. Under this scenario, its employment level is projected to increase a little over threefold in the next decade and a half (Table 6).

While each of the sector's several products have different value chains, the case of one product—dairy—can illuminate some of the main issues in the sector. The dairy sector is unique in that a small number of large processing firms heavily dominate. These firms are located in Kigali and source their raw materials directly from farmers and milk-collecting firms. Large firms primarily purchase from the import sector as inputs into the production process, but also from other large firms. VAT data allow an analysis of production chain relationships but excludes the common practice of processing milk within the household for auto-consumption or sale. Figure 4 illustrates the relationship among actors in the value chain: Medium-sized dairy middlemen purchase from farmers and then resell to the dominant firm in the industry.

One firm, Inyangye Industries, dominants milk production (Figure 4). This firm knits virtually the entire market together. Attached to this firm are smaller dairy companies that either process dairy themselves and share some of the same supplier firms, or work as suppliers to the main dairy producer. Finally, there are other dairy producers that do not share any linkages to other firms in the sector. Market power of the dominant firm is circumscribed by a competitive fringe of local informal producers and import competition, primarily from processed milk producers in Uganda.

**Figure 4: One firm is at the center of the dairy industry**



**How to interpret the graph:** Each circle indicates a firm and each edge is a transaction within the fiscal year 2013/2014. Larger circles indicate the firm has more connections to other firms in the sector. Blue circles indicate the firm is in the dairy sector, a red circle indicates the firm is either a customer or supplier of the sector.

Source: Spray and Argawal (2016).

Critical imported inputs into the production process include machinery, cartons and packages, and flavorings. Most of these inputs are too technically challenging for local producers to manufacture, though eventually it is likely that producers move into the production of these inputs as the simple packaging sector in Rwanda and the EAC grows.. Imports to the sector include animal products from the DRC; chemical products from Kenya and Uganda; plastics, paper cartons, and rubber from Kenya and Uganda; and electrical and other machinery from other countries.

Most sales of the industry go to the domestic market. However, exports of concentrated and non-concentrated milk, butter, and yogurt now comprise a large share of exports going to the East African regional market. Historically, the DRC alone has accounted for over 70 percent of dairy exports. However, in 2018, around 50 percent of milk exports went to Uganda with similar exports values to the DRC.

In the dairy sector, the government has fostered growth through its indirect support of the dominant firm, a company that belonged to the RPF's Crystal Ventures conglomerate.[15] The state has also fostered the sector's growth through the One Cow Per Poor Family Program, launched in 2006 with the aim to improve nutrition and income of low income families. So far, the program has distributed close to 350,000 cows. Alongside this initiative, a school milk program was piloted in 2011 to provide milk to grade schoolers and a ready market for milk producers. Infrastructure investments were also made to set up a national network of milk collection centers together with support for husbandry services and disease control.

As a result of these initiatives, Rwanda has achieved close to 70 percent of its targeted milk production under its medium-term development strategy: Milk production has increased from around 50,000 metric tons in 2000 to almost 850,000 metric tons in 2018. The national cattle herd has transformed from one dominated by low-productivity local cow breeds to a national herd of 1.35 million, with close to 55 percent of the herd made up of improved dairy breeds. Per capita milk consumption has also steadily increased from below 20 liters per year in the 1990s to 64 liters per year in 2015.

Despite improvements in the sector, the government is still addressing two major constraints in the sector: low productivity and low milk quality. To provide incentives to invest in more high-performing

15 *The Economist* reported that Brookside Dairies, owned by the family of Kenyan President Uhuru Kenyatta acquired a majority holding in Inyange Industries from Crystal Ventures, (see "The Rwandan Patriotic Front's Business Empire" *The Economist*, March 2, 2017).

farms and post-harvest operations, pricing schemes that reward quality are essential. Increasing the prevalence of quality-based pricing requires government leadership and continuing technical assistance to small producers. Improving value addition and product differentiation are concomitant goals necessary for promoting intra-industry trade.[16] In 2016, the government passed a ministerial order to regulate the collection, transport, and sale of milk. Inspections were ramped up and training programs were designed and implemented to upskill producers, distributors, and sellers on approved safety standards.

**Box 1 : Strengthening the dairy value chain through the Rwanda Dairy Development Project**

The Rwandan Government, in partnership with the International Fund for Agricultural Development (IFAD) and Heifer International, among others, has been implementing the Rwanda Dairy Development Project (RDDP), a $65 million project designed to support 80,000 on-farm and 20,000 off-farm dairy value-chain workers for the period 2016-2022. In addition to improving dairy production and market access, the program has targeted job creation and skills upgrading, most notably through Livestock Farmer Field Schools (FFS), where farmers are placed in learning groups led by a trained facilitator. Since 2016, almost a thousand FFS groups—consisting of around 24,000 farmers of which 43 percent are women—have been set up. By 2022, the program hopes to triple the number of groups and beneficiaries. Farmers in an FFS engage in experiential learning to improve husbandry and business management skills—skills that are central to improving productivity.

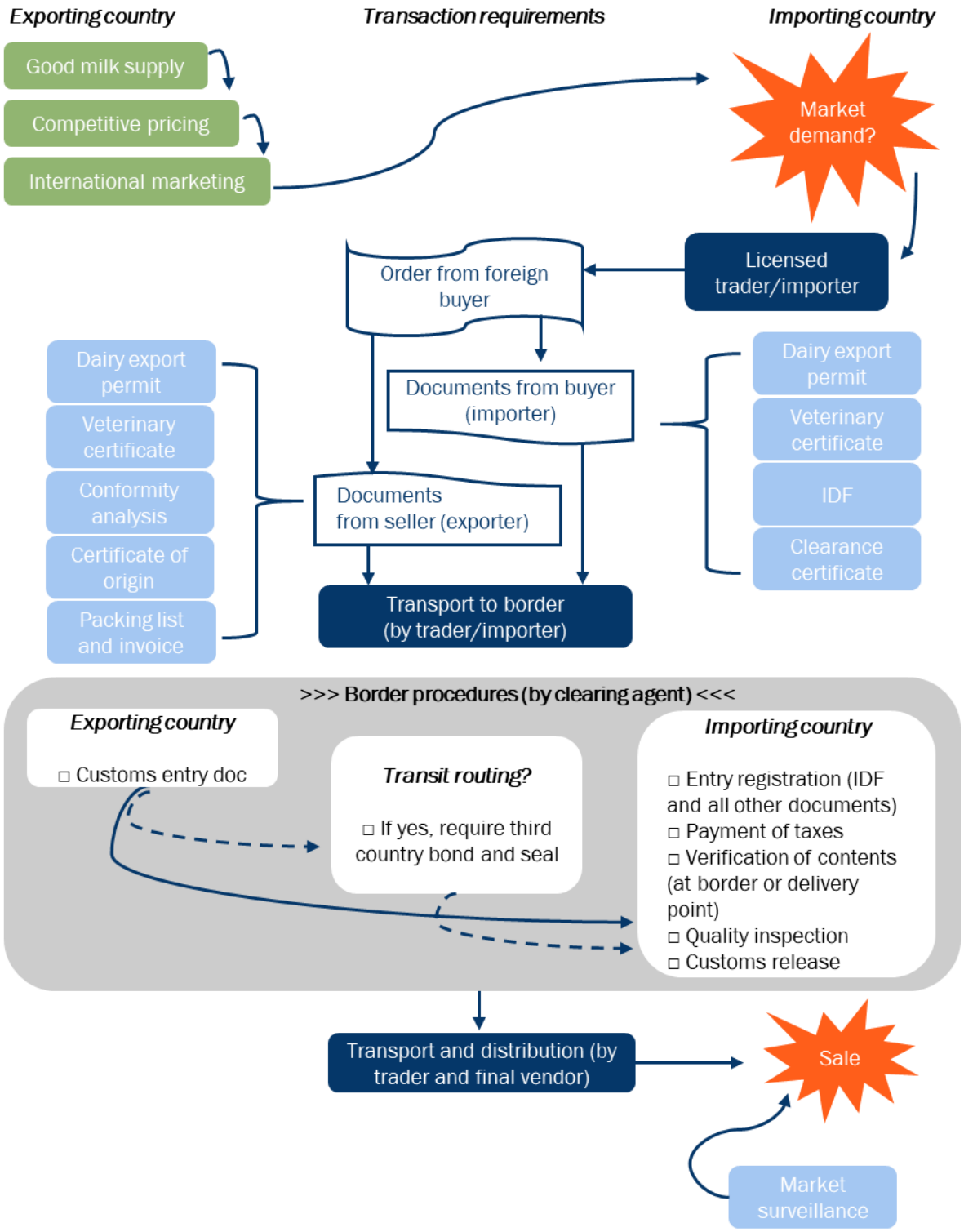
Source: Authors.

Regional cooperation is also imperative. At the moment, all the countries in the region are expanding their capacities in producing similar value-added products such UHT milk, yogurt, butter, ghee, and cheese, thus creating excessive price competition that has led to the imposition of non-tariff barriers throughout the EAC. Greater regional cooperation taking into account the comparative advantage of each country could lead to more competition in processed, differentiated products. Regional interventions could bring additional support to innovative production and marketing models being developed such as dairy hubs, cooperatives, and dairy self-help groups (DSHGs) (see Bingi and Tondell, 2015).

Importantly, all of these measures would have to be coupled with a reduction in non-tariff barriers in the sector to be successful.[17] As can be seen in Figure 5, numerous permits and regulatory sign-offs to engage in trade create obstacles to effective trade.

16 This section benefits from Bingi and Tondell (2015).
17 Jensen, M. and J. C. Keyer "Standards Harmonization and Trade: the Case of the East African Dairy Industry" in O. Cadot and M. Malouche (eds) (2012) , Non-tariff Measures: A Fresh Look at Trade Policy's New Frontier Washington: World Bank.

**Figure 5: Dairy suppliers face administrative hurdles**

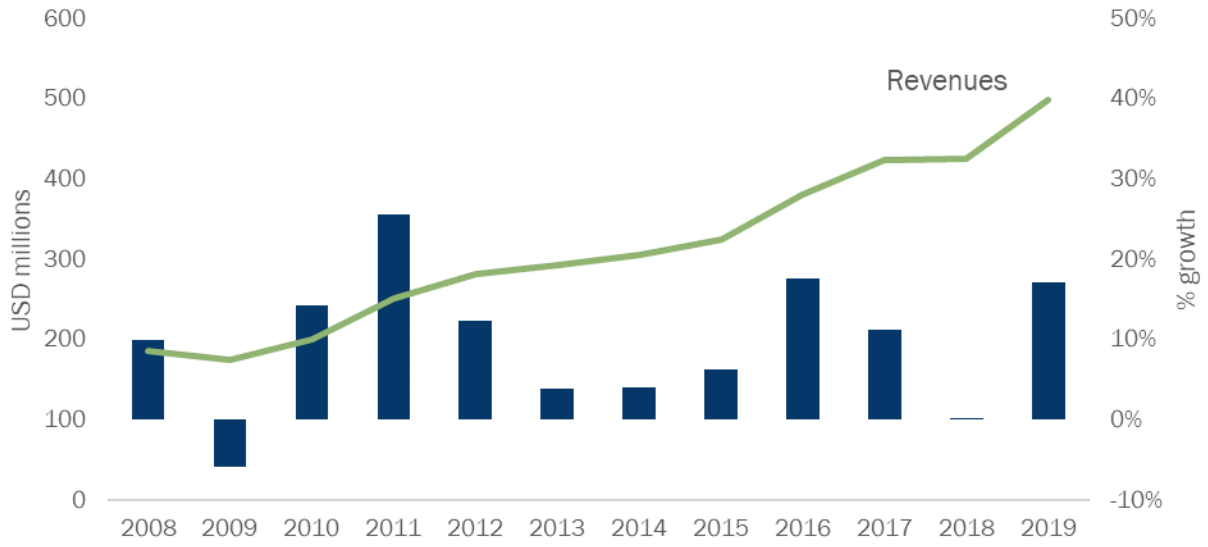



Source: Jensen and Keyser (2018).

## Tourism

Tourism has been the single most important source of foreign inflows since 1999, surpassing combined traditional exports—coffee, tea, and unprocessed minerals (Daly and Gereffi 2016; World Bank 2015). In 2018, tourism generated over $400 million in revenue (Figure 6) and consists of four main industries: accommodation services, food and beverage, passenger transport services, and travel agencies (Figure 7). Today, tourism employs more than 3 percent of the labor force.

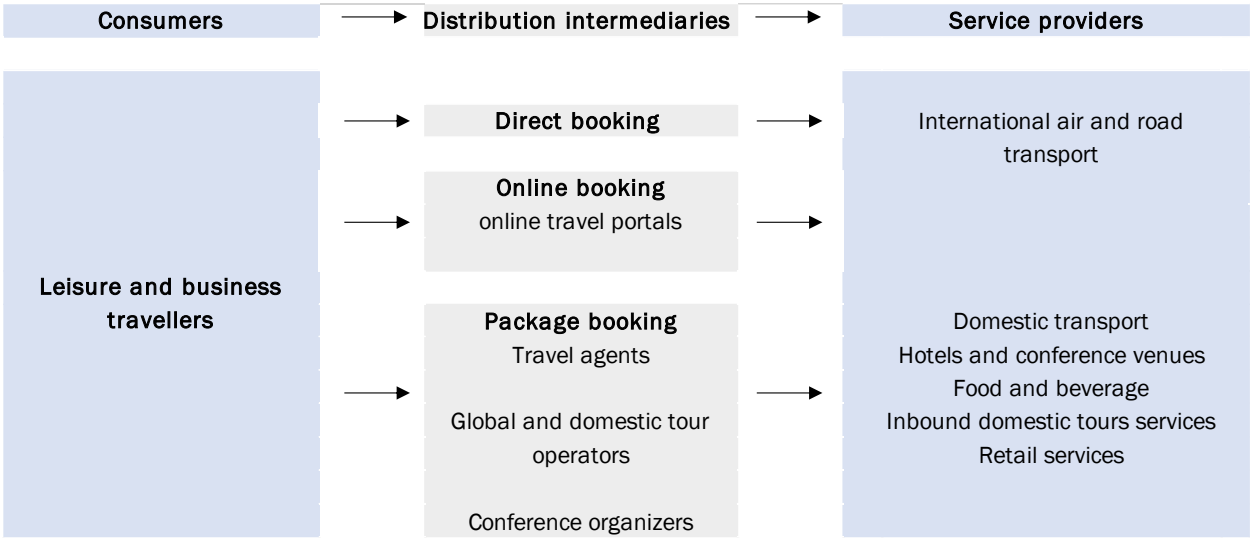
**Figure 6: Tourism revenues**




Source: Rwanda Development Board, 2020

The government has invested in tourism infrastructure to increase annual tourism visits. Construction and renovation of accommodation units such as hotels is also on the rise, especially in Kigali, which might bring down the cost of accommodation and increase tourist arrivals in future years. Consequently, foreign and domestic investment in the sector has been substantial in the last 10 years. In 2016/2017, the private sector invested close to $300 million in the tourism sector (Rwanda TSA 2017, Table 8) with a significant share going to accommodation and food and beverage serving services facilities. Complementary investment from the government over that period totaled close to $150 million at the national and district levels. Substantial investments have gone into Bugesera airport, Kigali International Airport, Kigali Convention Centre, Kivu Belt, sports centers, and the national air carrier (Rwandair)—leading to a diversification away from simply gorilla-based tourism, towards a new strategy of meetings, incentives, conferences, and exhibitions (MICE).

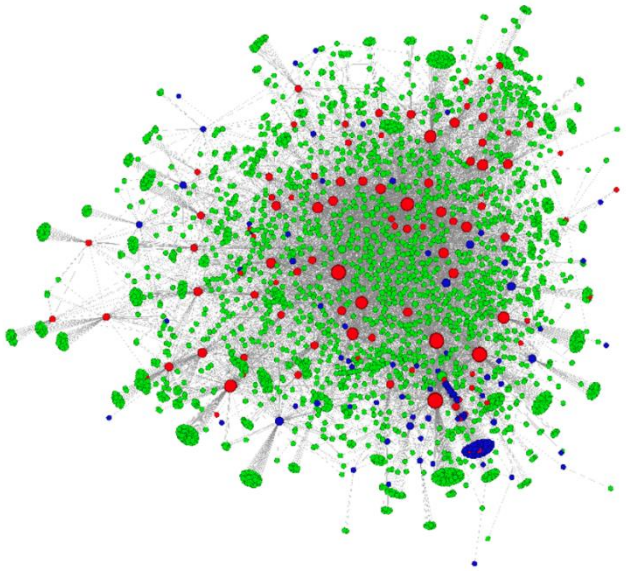
**Figure 7: Tourism value chain: A complex set of transactions and relationships**




Source: Adapted from Daly and Gereffi (2017).

Hotels are, by far, the biggest companies in this sector, and purchase goods from numerous other smaller companies. Many of these hotels are linked across the whole sector and support a large supply chain. However, unlike in agricultural or dairy chains, the importance of any one firm is much smaller, meaning the market is more resilient when facing firm-level shocks. For example, if one hotel went out of business, it is likely that the bankrupt hotel's suppliers would be absorbed by other hotels in the industry. Similarly, having more firms is likely to reduce the risk of monopoly pricing, as competition prevents any one firm setting prices above the equilibrium market price.

**Figure 8: Hotels are at the center of the tourist sector**



**How to read the graph:** Each circle indicates a firm and each edge is a transaction within the fiscal year 2013/2014. Larger circles indicate the firm has more connections to other firms in the sector. Red circles indicate the firm is a hotel, a blue circle indicates the firm is a tour company, and green circles represent suppliers to these firms.

Source: Spray and Agrawal (2016).

Tour companies are also crucial to the tourism sector's market structure. Although tour companies are not as large as hotels in their number of customers, many of the tour companies have linkages with hotels, essentially linking up the sector. Without these tour companies, it is unlikely that there could be so many hotels operating.

Imports are key to the functioning of the tourism sector, constituting 77 percent of the backward supply chain trade volume. The tourism sector's biggest suppliers are the wholesale and retail sectors, as well as other key service sectors such as construction, ICT, and food vendors. The sector buys a large volume of materials typically associated with construction: basic metals, cement, furniture, glass, and ceramic products (see Spray & Argawal, 2016).

The government has used public investment as the main instrument of industrial policy with substantial investments in a convention center, a new airline, remodeling its existing airport, and the construction of a new airport. The government has guaranteed loans for selected hotel construction companies, and hotel capacity has expanded exponentially. The government has invested heavily in overseas marketing—including on the shirts of Arsenal players in Britain. It has also worked with Kenya and Uganda to set up a regional tourist visa, and has eased entry requirements for most African countries and many high-income countries. It has begun focusing on medical tourism, with the aim of making Rwanda the medical tourism hub of the EAC. Investment in high-class and specialized hospitals like the Rwanda Military Hospital (RMH), where patients from the EAC and beyond can come for high-quality medical services, is expected to boost medical tourism in particular, and generally increase tourist arrivals and revenue. Notwithstanding numerous challenges in realizing this goal, Rwanda has the potential to attract medical tourists from the DRC, a large neighboring economy, where health services are relatively less efficient.

**Box: Mastercard Foundation Hanga Hazaza employment program for the tourism sector**

Recognizing the vital role of tourism as an employer for the youth, the Rwandan government approved a $50 million project, designed and financed by the Mastercard Foundation, to upskill 30,000 youth for careers in the tourism and hospitality sector. Launched in 2018, the program, through its consortium of partners from the education, development, and private sectors, has focused on skills development and employment promotion.

Major initiatives under the program include support for a curriculum review and update for technical and vocational education and training (TVET)-related courses; skills training for facilitators to improve course delivery; short courses to improve service delivery for hotel staff; and programs to enhance access to business capital and credit through the program's financial partners.

Source: Authors.

The main challenges, putting the 2020 pandemic crisis aside, are continuing to upgrade services and attractions. If the average length of stay is doubled from its current average of fewer than 4 days (Rwanda TSA, 2017) to a week, it would markedly expand tourism revenues (see English and Murray, 2016). Working with tour operators and hotel chains to bring in more tourists could well create a new tourist circuit that would link the gorillas, the virgin forests, and the attractions on Lake Kivu to the big game parks in Tanzania and Kenya.

### Information and communications technology (ICT)

Rwanda, like many other African countries, has benefited from leapfrogging 20th-century fixed-line technology to the 21st-century mobile technology. By 2017, ICT was composed of some 12,000

workers, a small share of the total labor force. These numbers do not include a large section of relatively low-skilled workers acting as vendors for mobile money.

The sector is growing and likely to become even more of a major driver of growth in the next decade and a half. The government's high-growth and aspirational scenario projects employment in ICT to rise to around 100,000 workers by 2035.

Mobile phone ownership stood at around 67 percent in 2017, and 4G LTE (Long-Term Evolution) was rolled out in November 2015, with an ambitious target of connecting 95 percent of the population to the technology by mid-2017. Around 22 percent of Rwandans use the internet according to 2017 estimates (ITU, 2020). In the financial services sector, the digitization agenda has seen tremendous modernization of service delivery and the emergence of pro-poor and augmenting financial innovations.

Mobile money—a financial product that allows users to make financial transactions via mobile phone—was introduced in February 2010 and has since revolutionized financial inclusion and payments efficiency. The number of mobile money users shot up from nearly 200,000 in 2010 to over 4 million in 2019. Partnerships between mobile network operators (MNOs) and commercial banks leverage market potential among people formerly without access to the financial system, especially in rural communities. Unexploited opportunities still exist for Rwanda to achieve its goal of being the ICT hub of the EAC, expanding its export of ICT services in the region, and increasing the competitiveness of its exports.

ICT contributed 1 percent of GDP in 2018 (Rwanda National Accounts, 2019). The multi-phase National ICT Strategy and Plan outlines the government's strategy to support the ICT sector: The first phase (2001–2005) focused on institutional, legal, and regulatory reforms, liberalization of the telecom market, and reducing entry barriers. The second phase (2006–2010) centered on establishing world-class communications infrastructure as a backbone for the country's communication needs. The major goal in the third phase (2011–2015) was to develop ICT for improved service delivery in both the private and public sectors. In the last phase, the government aimed to use ICT to build a highly skilled and knowledgeable labor force (skills development), stimulate competition and innovations in the private sector, empower communities through improved access to information (community development), improve efficiency and service delivery in government operations (e-Governance), and secure the country's cyberspace and information assets (cyber security). Many of these objectives remain central under the new ICT Hub Strategic Plan (2019-2024), which has a particularly strong focus on skills upgrading and job creation.

ICT continues to drive innovations in several other sectors, offering great growth potential for the economy. The government is a major consumer of ICT services through its line ministries and authorities. One of the main landmark digitization initiatives was the establishment of electronic and mobile declaration (e-declaration and m-declaration) of tax returns by the Rwanda Revenue Authority in 2011. The success of this initiative was backed by the 2015 introduction of mobile payment for taxes—both initiatives ultimately saving taxpayers time and transport costs that would have been incurred in declaring and paying taxes in a traditional manner. The regulatory agency, the Rwanda Development Board (RDB), has worked closely with technology solutions companies to earmark the digitization of 100 services, including applications for birth certificates, registration, and payment of school examination fees, among other key services.

The education sector has also embraced ICT by designing online learning platforms and creating the private–public partnership in 2014 between the government of Rwanda and the technology company Postivo BGH to set up a laptop factory in Kigali and sell laptops to schools. The development of mobile apps such as Rapid SMS and e-Diagnosis in the health sector have eased knowledge sharing and patient tracking for health service providers. In the agriculture sector, the Fertilizer Voucher Management System helped smooth the distribution of fertilizers to farmers; farmer uptake rose by

11 percent between 2013 and 2014. Other market platforms like e-Soko help farmers access real-time price information for agricultural produce.

The government has identified a few major challenges to the sector: Expansion of critical ICT infrastructure and investments has been slow; digital literacy and enrollments into ICT-related programs remains low; and costs of hard infrastructure ICT projects are high due to additional transport costs. Addressing these challenges requires government and private sector solutions that are capable of attracting the investment required.

The cost of implementing the 2019-2024 strategy is estimated at around 1 percent of total GDP. The government plans to rely on a menu of financing options, including grant financing, government financing, debt and equity financing where possible, and private sector financing. To address issues around poor project implementation and management, the government has committed to implementing a results-based management system (RBM) with consistent monitoring and evaluation against the strategic objectives.

Finally, the government, recognizing the importance of preparing the labor force to support the growth of the ICT sector, has outlined a detailed strategy to tackle barriers that the labor force faces in securing ICT-related jobs.

**Box: Generating employment under the Rwanda ICT Hub strategy**

ICT is a priority sector for employment under the Rwandan Government's National Strategy for Transformation (NST1) as well as its more long-term Vision 2050. Sector strategies have been effective tools for operationalizing high-level sector priorities, and, in 2018, the government rolled out its ICT Hub Strategic Plan (2019-2024) with a focus on policy and programs to "build a critical mass of educated and IT skilled workforce." The government has outlined four objectives to boost employment in ICT: (i) increase the number of enrollments in ICT training programs and courses; (ii) provide information on the path to and benefits of a career in ICT; (iii) position Rwanda as an attractive ICT hub for international students and; (iv) create sufficient employment opportunities to absorb trained ICT graduates (MINICIT, 2018).

The Ministry of Education, one of the implementing ministries under the strategy, has two pipeline projects to support skill development: the Digital Literacy Program and the ICT Career Counselling Program. The Digital Literacy Program has targeted full digital literacy among the youth, age 16-24, and at least 60 percent within the adult population by 2024. Additionally, through a network of national ICT counselling groups, the government hopes to increase awareness and encourage successful uptake of ICT career paths.

Source: Authors.

## Back to the big picture: Commonalities and constraints

Five common patterns emerge from this review of value chains in the IWOSS sectors in Rwanda. First is the centrality of imported inputs and services to the sectors' success. Whether horticulture, agro-processing, tourism, or ICT, access to imported inputs at border prices has been key to the international competitiveness of the sector, evident in export performance. Similarly, the role of services—notably transport, finance, and construction services, among others—as inputs into IWOSS non-service sectors has been key to overall performance as well.

A second pattern is the role of public investment and government strategy in launching and nurturing the private sector. Public investment in horticulture has taken the form of irrigation, cold storage facilities, and transport; in dairy, it has taken the form of a state-controlled company to promote value

addition and quality upgrading as well as public procurement through school-feeding programs. In both sectors, quality upgrading, improving access to fertilizer and other inputs, and strengthening backward linkages has proved fundamental. Furthermore, in tourism, public investment has been a driving force in hotel development, air transport, site development in gorilla tourism, and the convention center; and in ICT public procurement has played an important role.

Third, in all of these sectors, increasing productivity has required exporting. Global markets are, of course, central to coffee, tea, cut flowers, and tourism. Regional markets have been particularly important for agro-processing, such as flour from maize, and dairy products, particularly in the form of exports to the DRC.

Fourth, in all of these sectors, technology will be crucial for further development, especially for increasing exports and for creating high-productivity jobs. This fact is both a constraint and an opportunity. In all sectors, technology is pivotal for future growth and job creation, and access and adaption to technology requires significant investments. At the same time, many aspects of the next stage of sectoral technologies are already known, and an aggressive public sector and an innovative private sector can adapt these emerging ideas to the Rwandan context.. Here too government programs such as those under development through the National Industrial Research and Development Agency, the Rwanda Development Bank, and the Rwandan Development Board will play a leading role.

Finally, these sectors will all entail substantial increases in employment for young people and other new entrants into the labor force. However, the emergence of these sectors will require not only new technologies but also more skilled workers to make them grow, thus creating a skills bias in the growth model. On average, the percentage of low-skilled workers will decline in these IWOSS sectors and the percentage of high- and medium-skilled workers will increase. This trend underscores the need to upgrade educational quality if the government's aspirational scenario is to be achieved. Also, without offsetting fiscal policies and efforts to improve educational opportunities for youth, particularly from the poor rural sectors, this skill-biased pattern of growth implies a strong tendency for income to become more unequal. We take up these two considerations in more detail in the concluding section.

# 5. Policies to promote youth employment

Filling the jobs of tomorrow in Rwanda will require significant investments in children, youth, and adult workers, including notably women. Business surveys already point to the lack of skilled labor as a major constraint on business growth—and this trend is only likely to intensify. Increasing the human capital of young Rwandan workers has three components—boosting basic, technical and advanced conceptual skills. With a current average educational attainment of 4.1 years of schooling, the country has to focus on providing the basic skills essential for the post-2020 economy in Rwanda. Even as it increases time in school, the country has to improve educational outcomes if the country is to achieve its high growth aspirations. Second, it has to upgrade its secondary schools and vocational and educational training systems. Finally, the country will benefit from further reforms to its tertiary school system and universities.

### Basic education is fundamental

Even though expected years of schooling of a typical student in Rwanda doubled from 5.7 to 11.1 years over the 1990-2017 period, Rwanda´s current workforce average schooling of 4.1 years remains below the sub-Saharan mean (5.6 years) and the average for low ranking countries on the Human Development Index (4.7 years). This shortage of basic education challenges late-stage upskilling initiatives, as certain skills (e.g., languages) are more easily trained at a young age (NSDEPS, 2020).

Improving access to basic schooling is a high priority. Even though all children have nominal access to schools, primary education is not completely cost-free to parents. Parents may have to invest in school uniforms, and it is not unusual for parents to contribute to schools. Children are not infrequently turned away from taking exams for failure to pay incidental fees. Making primary education truly cost-free may require increasing the per student benefit paid to schools. Outsourcing primary education to the private sector more broadly is unlikely to reduce costs significantly, but offers some gains at the margin.

Improving educational quality has to go hand-in-hand with increasing cost-free access. For example, roughly 85 percent of students that have completed grade 3 were rated "below comprehension" on a recent reading test, while one in six students could not answer a single reading comprehension question (GOR/WBG, 2019). Recruiting, training, and monitoring teachers are important components of upgrading basic education. At present, many teachers are not fully equipped to teach their subjects. While teacher salaries are an important determinant of workforce quality, the government, with the help of the International Growth Centre (IGC), has been experimenting with non-monetary rewards to improve quality, such as pay-for-performance incentive schemes and choice in school assignment for teachers during periodic rotations. Reducing class size is no less important. In Rwanda, students not performing satisfactorily on end-year exams are held back, and classes are large with varying ages of students in the same grade, especially in the early grades. Another issue is the language of instruction. Providing education during the first three years in Kinyarwanda before transitioning to English would improve basic literacy. Since many teachers themselves lack proficiency in English, leveraging Rwanda's past investment in technology to provide upper-primary and secondary school teachers with regular opportunities to improve their English could improve teaching (see GOR & WBG, 2019).

### Vocational education is no less important

Technical and vocational education and training (TVET) has current enrollment of slightly more than 30 percent of Rwandan youth. Unfortunately, TVETs have not been fully effective in preparing students for the workforce: Employers rank programs poorly—only 60 percent of employers found TVET graduates with satisfactory skills (NSDEPS, 2019). In 2018, the unemployment rate among TVET graduates amounted to 17 percent; moreover, roughly half of TVET graduates reported that they were not satisfied with their skills development. This situation can be attributed to two elements: insufficient private sector involvement in curriculum design and implementation, and nascent performance tracking especially for TVET institutions and labor market outcomes.

Collecting and disseminating information on the quality of skills providers and the returns to different skills would improve quality and encourage participation in high-return programs.

### Tertiary education will increase the supply of high-skilled workers

Even though university enrollment has doubled in the last decade, only 8 percent of tertiary-age youth are enrolled in tertiary education, well below the level in middle-income countries. Moreover, relatively few graduates are specializing in key job creation fields, such as science and engineering. Just 6 percent of university students in Rwanda are enrolled in engineering, manufacturing, and construction, and only 9 percent are studying sciences. If Rwanda intends to grow its manufacturing and technology sectors, then the number of students in sciences and engineering clearly also needs to grow (FDG, 2019).

Increasing access to financing (including private) would expand enrollment. Enrollment in high-return fields could be increased through financing incentives and higher-quality science and engineering instruction in earlier grades. Creating incentives for researchers to develop and adapt innovations to benefit industries and getting industries to pay for the research are essential for reaping the maximum returns to innovation.

## The policy response: The National Skills Development and Employment Promotion Strategy (NSDEPS)

In late 2019, the Rwanda Development Board, in collaboration with the Ministry of Education and other official agencies, launched the National Skills Development and Employment Promotion Strategy (NSDEPS). This strategy is squarely aimed at addressing shortcomings in the current educational system and provides new direction for labor force development in the future.

The program is comprehensive and organized around three pillars, each with a subset of actionable programs with defined performance benchmarks:

- *Skill development.* Enhancing the provision of skills of new entrants to the labor force as well as existing workers. These efforts include reforms to basic education, TVET, and universities, with a heavy focus on implementing recommendations arising from national strategies as well as suggestions in the Future Drivers of Growth study (GOR/WBG, 2019). Three initiatives are worth highlighting. The *National Training and Education Excellence Program* will create visibility on the effectiveness of TVETs and higher education institutions, reward outperforming institutions, identify best practices, and solve critical emerging issues. The *Market-led Education Initiative* will support a demand-led approach by elevating the voice of the private sector, reinvigorating the Sector Skills Councils, and ensuring that the sectoral skills gaps are clear. The *Capacity Development Programme* will (a) allow skills development to be responsive to investors and the development priorities of the government (e.g., financial hub, health tourism, etc.), and should complement the RDB's investment promotion activities; and (b) support capabilities development within the public sector. Success under these programs will not only build skills for the present, but also for the future by creating pools of talent that can be used as pathways for ever-more complex industries.

- *Employment promotion*. This pillar focuses on programs to support the creation of jobs, and, thus, opportunities for the workforce. Focusing on small and medium enterprises, this pillar seeks to respond to their three main challenges: access to markets, access to finance, and access to business advisory services. This pillar focuses on promoting business growth through four programs. First, the *Access to Markets Program* will support Rwandan firms by facilitating access to domestic and international markets. Second, the *Access to Capital Program* will provide appropriate finance to Rwandan businesses, enabling them to grow. Third, the *High-Quality Business Advisory Services Program* will build businesses' capabilities and know-how. Finally, the *Labor Market Analysis Program* will provide analysis on the impact of government policies on employment in order to inform decisionmaking.

- *Matching workers with jobs.* At present, job-seekers and employers struggle to connect effectively with each other. As a result, there are mismatches between labor supply and demand, and individuals may not be employed in an appropriate job. Personal connections (32 percent) are the leading mechanism for TVET graduates to access their first source of employment. For higher education graduates, responding to a job advertisement (27 percent) is the most popular. Most surprising is the lack of involvement of universities: Schools help with just 2 percent of job placements. In addition, only around 5 percent of unemployed Rwandans have used employment services or online tools to seek employment. This pillar aims to support a well-functioning jobs ecosystem that connects job seekers, employers, and the education pipeline. The *Evidence Based Workforce Planning and Matching Program* will support an ecosystem where employers and workers can find each other, and educators can adapt rapidly as workforce needs change. An integrated data system connecting job-seekers' profiles and job opportunities will be the cornerstone to achieve this goal. Furthermore, it will enable ongoing labor market planning to better align the demand and supply sides over time. The *Strengthening Employment Services and Career Guidance Program* will promote active

linkages between skills supply and demand, providing incentives for career services and matching providers based on performance. The *Graduate Labor Market Transition Program* will build market-relevant skills among the youth and help firms and institutions identify and test suitable talent. The *Global Talent and Opportunity Program* will support the closing of skills gaps through the import of talent (foreign and diaspora), by proactively seeking out these individuals and facilitating their transition into the Rwanda jobs market.

The government's planned activities focus on demand-driven interventions, specifically skill development that fulfills the needs of current businesses and potential investors. It emphasizes strong private sector engagement and leadership, coupled with new efforts to monitor and evaluate impacts based on employment outcomes. It also emphasizes experimentation, effectiveness, and flexibility to "test and learn" ideas and adapt programming quickly. These findings will support allocating resources to what works best through performance-based management.

Finally, according to the National Skills Development and Employment Promotion Strategy (NSDEPS, 2019), women are 20 percentage points more likely to be out of the formal labor market than men (54 percent compared to 35 percent). Moreover, women are more likely to be unemployed than men (17 percent compared to 12 percent in 2017). This situation is typically because women have more limited access to education and face discrimination in employment. They are more frequently engaged in subsistence agriculture and unpaid domestic labor.

Similarly, those in rural areas are substantially more likely to be out of the formal labor force. Underemployment is far more prevalent in rural areas, compared to urban ones. Rural workers experience similar unemployment to urbanites, but, because of seasonal fluctuations in agricultural demands, they are almost three times more likely to be underemployed (32 percent compared to 12 percent). The youth and the mature middle-age workers, having received limited education, are also less likely to be integrated into the labor force (although a significant share of youth out of labor force are in full-time education).

# 6. Conclusion

Rwanda has made great strides in using structural transformation to drive its growth and job creation. Its policies have generated a diverse and increasingly complex economy in which jobs have been created at a rapid pace in higher productivity activities. This process has pulled workers out of subsistence agriculture into industries without smokestacks—including high productivity agriculture and services—as well as incipiently manufacturing. These sectors have led the growth process. Manufacturing, though still small, is becoming a dynamic complement to this process.

The growth process creates a demand for ever higher skilled labor. While producers complain even today that the lack of availability of skilled workers inhibits their growth, the aggregate numbers in the government aspirational scenario and value chain analysis show that this gap is likely to be case in the decades ahead.

Thus, the government must rapidly invest in its workers and innovation to sustain its growth momentum, lest the lack of skilled workers and professionals become a brake on growth. Moreover, the skill-bias inherent in the growth process—driven by industries without smokestacks and manufacturing—will drive an undesirable increase in inequality. Thus, there are two reasons to invest heavily in workers' skills: 1) to avoid letting skill shortages weigh down growth rates and 2) to ensure that the rising incomes are more equitably shared.

The review of policies and programs offers a source of optimism. The government has developed a sophisticated set of policies to use skill development, business creation, and job matching to alleviate any skills deficit and constraint on growth. The challenge ahead will be to realize the potential of these programs.

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# Annex A. Methodological notes: data sources, uses, and projections data

## Data sources

*Integrated Household Living Condition Survey (EICV)*

Employment is measured using the Integrated Household Living Conditions Survey (EICV) for 2000/2001, 2010/2011, and 2016/2017. Rwanda started conducting a new and more frequent audit of its labor force in 2016. The Labor Force Survey (LFS) has superseded the EICV as the most accurate source for employment statistics. Unfortunately, the short panel of data from the LFS does not allow us to adequately understand the economy's employment dynamics. Additionally, the statistics agency has not updated the EICV employment numbers to correspond to those in the LFS, limiting our ability to extend our analysis beyond 2017. Therefore, for this report we rely on employment estimates from EICV, which gives us employment statistics for 2000, 2010 and 2016.

The EICV is a cross-sectional survey based on a sample of respondents stratified at the district level; sample villages are selected with each village's chance of sampling proportional to the size of its population. Consequently, the EICV's results are representative for an estimated population of around 11.8 million and 5.8 million workers. The survey includes a series of questions on the employment status of the respondent for 12-month window. A person with multiple jobs is asked to identify their main job—defined as the job with the most work hours spent within the period.

Notably, under the EICV, subsistence agriculture is considered a form of work; however, the LFS excludes subsistence agriculture workers entirely. Table A1 compares employment measures for both surveys.

**Table A1: Comparison of employment definitions in EICV 2016/2017 and LFS 2016**

| Indicators | EICV 2016/2017 definition | | | Labor force survey definition | | |
|---|---|---|---|---|---|---|
| | Total | Urban | Rural | Total | Urban | Rural |
| Labor force participation rate | 76 | 70.7 | 77.6 | 50.6 | 62.8 | 47 |
| Employment-to-population ratio | 71.9 | 62.3 | 74.9 | 41.1 | 52.5 | 37.7 |
| Unemployment rate | 5.3 | 11.9 | 3.5 | 18.8 | 16.4 | 19.8 |
| Youth unemployment rate | 7.9 | 15.7 | 5.3 | 21.5 | 19.4 | 22.5 |
| Average usually-working hours | 36.4 | 47.7 | 33.6 | 40 | 50.7 | 35.5 |
| Median usually-working hours | 34 | 46 | 30 | 36 | 48 | 35 |

Source: Rwanda National Institute for Statistics, Labor Force Survey (2016).

*Establishment census*

For our firm level estimates, we use the 2011 and 2017 Establishment Census. The census enumerates all firms classified as establishments for the purpose of undertaking an economic activity.

A firm is captured under the census if it falls under one of the following categories: all private establishments belonging to private individual or organization rather than state or public body; all public institutions and business owned by government; all religious establishments; and all non-profit, citizen-based groups that function independently of the government. The census tracks multiple firm characteristics, including ISIC sector and the number of employees. Merging the ISIC sector classifications used in the census with our IWOSS sector classifications allows us to categorize firms as either IWOSS or non-IWOSS.

*Administrative tax data*

Another data source for firm-level estimates is anonymized administrative tax data from the Rwanda Revenue Authority capturing firm tax declarations. We use a merged data set of the corporate income tax (CIT), pay as you earn (PAYE), and value-added tax (VAT) data for our analysis. The CIT and PAYE allow us to estimate the number of reporting firms by year and the number of employees declared by each firm during tax filing for each of our IWOSS sectors. Although this methodology limits our analysis to only a subset of formal and compliant firms, it gives us more insight into the structure of the formal economy. Finally, the VAT data captures VAT declarations and is used to understand the network dynamics of firms in the IWOSS sectors by looking at the number and characteristics of suppliers.

*National Accounts and GDP projections under Vision 2025*

Historical data on GDP comes from the national account reports compiled by NISR, and GDP estimates are based on the government's growth targets under it national development plan- Vision 2050. The plan outlines a roadmap for achieving middle-income status by 2035 and sets out growth targets: 9% between 2017 and 2020, 12% between 2024 and 2035.

*Export data (Automated System for Customs Data, ASYCUDA)*

Export data is compiled from two main sources: goods export values from Rwanda Revenue Authority ASYCUDA data and services exports from the National Institute of Statistics as reported in the annual balance of payments reports of the Central Bank. Trade in services is partly collected using survey instruments. IWOSS classifications are based on harmonized system (HS) codes, an international standard for numerically classifying trade in goods. The section on IWOSS classification expands on how these codes are mapped. Export data is reported for 2011 and 2017.

## Methodology: IWOSS sector classification, labor demand and labor supply estimates

The IWOSS classifications used in this paper partly draw from earlier work by Newfarmer et al. (2018). The conceptual paper by Bhorat et al. (2019) serves as the basis of our methodology on estimating labor demand, supply, and skills gaps. However, we have deviated methodologically in some areas in order to better situate our analysis within the Rwandan context. First, instead of linearly projecting GDP from historical GDP, we project GDP in line with existing economic growth targets from the government and labor force projections by the national statistics agency. Second, we project labor demand using adjusted employment elasticities and bound demand by the projected size of the working-age population in 2035. Third, we project skill distribution by sector using the trend in changes in skill distribution between 2010 and 2017. The following sections expand on our methodology.

*IWOSS classification*

Our IWOSS classification is based on the International Standard Industrial Classification of All Economic Activities (ISIC), which sets international standards for how to categorize economic activities within an economy. This naming system provides a systematic way for the government and statistical agencies to collect and report on various measures of economic activity. Under ISIC,

economic activities are subdivided into a "hierarchical, four-level structure of mutually exclusive categories": sections, divisions, groups, and classes (Table A2)

### Table A2: Example of ISIC four-level hierarchy

| | | |
|---|---|---|
| **Section** | C | Manufacturing |
| **Division** | 13 | Manufacturing of textiles |
| **Group** | 139 | Manufacturing of other textiles |
| **Class** | 1339 | Manufacturing of carpets and rugs |

### Table A3: Classification of economic activity into IWOSS sectors

| Sector | Major ISIC Group | Specific adjustments |
|---|---|---|
| **IWOSS** | | |
| Agro processing | C: Manufacturing | Estimated using ISIC groups under ISIC divisions 10–33 |
| Exports and horticulture | A: Agriculture, Forestry, and Fishing | Employment estimates using CGE model for Rwanda: IFPRI (2015) |
| Tourism | I: Accommodation and Food Service Activities<br>R: Arts, Entertainment, and Recreation | For 2010 and 2017, Employment estimates using CGE model for Rwanda: IFPRI (2015) |
| ICT | J: Information and Communication | |
| Transport | H: Transportation and Storage | |
| Construction | F: Construction | |
| | C: Manufacturing | Estimated using ISIC groups under: ISIC division 10–33 |
| Repairs | G: Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles | ISIC division 45–47 |
| | S: Other service activities | ISIC division 94–96 |
| Financial and business services | K: Financial and Insurance Activities<br>L: Real Estate Activities<br>N: Administrative and Support Service Activities | |
| Trade (formal) | G: Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles | Formal trade estimated using measures of formality in EICV |
| **Non-IWOSS** | | |
| Manufacturing | C: Manufacturing | Excludes estimates for agro processing |
| Agriculture | A: Agriculture, Forestry, and Fishing | Excludes estimates for exports and horticulture |
| Mining | B: Mining and Quarrying | |
| Utilities | D: Electricity, Gas and Air Conditioning Supply<br>E: Water Supply, Gas, and Remediation Services | |
| Trade(informal) | G: Wholesale and Retail Trade, Repair of Motor Vehicles and Motorcycles | Formal trade estimated using measures of formality in EICV |
| Domestic services | T: Activities of Households as Employers, Undifferentiated Goods- and Service-Producing Activities | Estimated using ISIC groups under ISIC division 97–98 |
| Government | O: Public Administration and Defence, Compulsory Social Security<br>P: Education<br>Q: Human Health and Social Work Activities | |
| Other services | S: Other service activities | |

By design, the ISIC structure allows for more detailed categorizations of economic activity. Most of our sectors are directly mapped onto ISIC sections (Table A3); adjustments are made to more precisely estimate agro-processing, exports crops and horticulture, repairs, domestic services, and trade. Adjustments for each sector are detailed in table A3. Agro-processing mainly consists of food and beverage production using ISIC group level under divisions 10-33. Similarly, the classification for repairs and domestic services is established at the ISIC group level under divisions 45-47, 94-96, and 97-98.

IWOSS classifications were done across all the different data sets used for this study to allow for comparisons across different years and in some cases across different data sets. Table A4 shows the number of types of economic activity classified. ISIC division codes were available for all the data sets (except export data from ASYCUDA) allowing us to first broadly apply the IWOSS classifications outlined in Table A3 and then refine estimates for specific sectors. The data sets are not perfectly comparable; for example, export and tax data only includes the universe of formal firms that declare taxes and trade through formal channels whereas the household survey and establishment census data include both formal and informal firms.

**Table A4: Economic classification by data source**

| Data source | Type of economic classification | Number of economic classifications |
|---|---|---|
| Integrated Household Living Conditions Survey (EICV1) | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes | 90 |
| Integrated Household Living Conditions Survey (EICV3 | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes | 106 |
| Integrated Household Living Conditions Survey (EICV5) | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes | 191 |
| Establishment Census | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes | |
| Tax Data (CIT, PAYE and VAT | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes and tax system classification | 181 |
| National accounts | International Standard Industrial Classification of All Economic Activities (ISIC): Section and division codes | 34 |
| Export data (ASYCUDA) | Harmonized System (HS) Codes: 2 digits | 98 |

### Labor demand estimates

In order to estimate the demand for workers in the overall economy as well as at a sector level, we first need to examine the labor-intensity of the different sectors. How does growth translate into jobs and are IWOSS sectors more or less labor intense than non-IWOSS sectors? Following from Bhorat et al. (2019), we calculate two of the three recommended measures of labor intensity*: labor-to-value added* and *employment elasticities*. Without an updated Input-Output table we are unable to estimate employment multipliers.

We estimate labor-to-value added for 2000, 2010, and 2017. For all three periods, valued-added data is obtained from the national accounts at the sector level and employment numbers from the national household survey (EICV). The estimation for labor-to-value added is a simple ratio of value added to employment. However, another measure includes i) a vector of employment per industry, P_(n×1),

where p_i is the number of employed individuals in sector i and ii) a vector of total value added X_(n×1), where each element x_i is the total value added for sector i. Here, sector i is one of our individual IWOSS and non-IWOSS sectors classified using the methodology discussed above.

Next, we transform the two vectors and calculating the labor-to-value added ratios:

$$N = DIAG(P)\big(DIAG(X)\big)^{-1} \quad (1)$$

Our labor-to-valued added estimates, i.e. value added per worker, by sector i are the diagonal elements of the matrix $N$. For our study, the labor-to-value added ratio is calculated in Rwandan francs per worker.

Although we can estimate demand using labor-to-value added ratios, we use employment elasticities instead. Employment elasticity measures the responsiveness of employment to output growth, thus providing another way to measure labor intensity as well as the employment potential of sectors. Similar to labor-to-value added, we use value-added data from the national accounts and employment number from the EICV to calculate the ratio of the percent change in value added to the percent change in employment. We do this for the overall economy, for IWOSS and non-IWOSS sectors as well as for our individual sectors. We consider the two periods 2000-2010 and 2010-2017 for our employment elasticities. Equation 2 outlines employment elasticity.

$$emp\_elasticity_{s(t)} = \frac{\%\Delta\ labour_{s(\ t,t-1)}}{\%\Delta\ GDP_{s(t,t-1)}} \quad (2)$$

*s=sector (agro-processing, tourism, utilities…) t=period*

*emp_elasticity*$_{s(t)}$ = Estimates employment elasticity for sector s in period *t*

*labor*$_{s(t)}$ = Labor force of sector s in period *t*

*GDP*$_{s(t)}$ = GDP of sector s in period *t*

The next step is to estimate the growth in value added needed to absorb projected labor force in 2035 (Equation 3). This is one of the areas where we deviate methodologically from Bhorat et al. (2019). Rather than linearly interpolate the growth of the economy, we estimate the labor demand based on the government's labor force growth targets for 2035. Albeit ambitious, the goal of reaching upper-middle-income status by 2035 shapes national economic policy and will continue do so over the next decade. Therefore, it is appropriate to structure our analysis around the government's targets with the goal of understanding the potential of employment potential of IWOSS sectors within this context.

$$labour_{S(2035)} = labour_{S(2017)} + (labour_{S(2017)} * \big(\Delta GDP_{s(2017,2035)}\big) * emp_{elasticity}{}_{s(2035)}) \quad (3)$$

s= *(sector agro-processing, tourism, utilities…)*

$GDP_{s(2035)}$ = Projected GDP in 2035 of sector s

$GDP_{s(2017)}$ = Estimated GDP in 2017 of sector s

$labor_{s(2035)}$ = Projected labor force of sector s in 2035

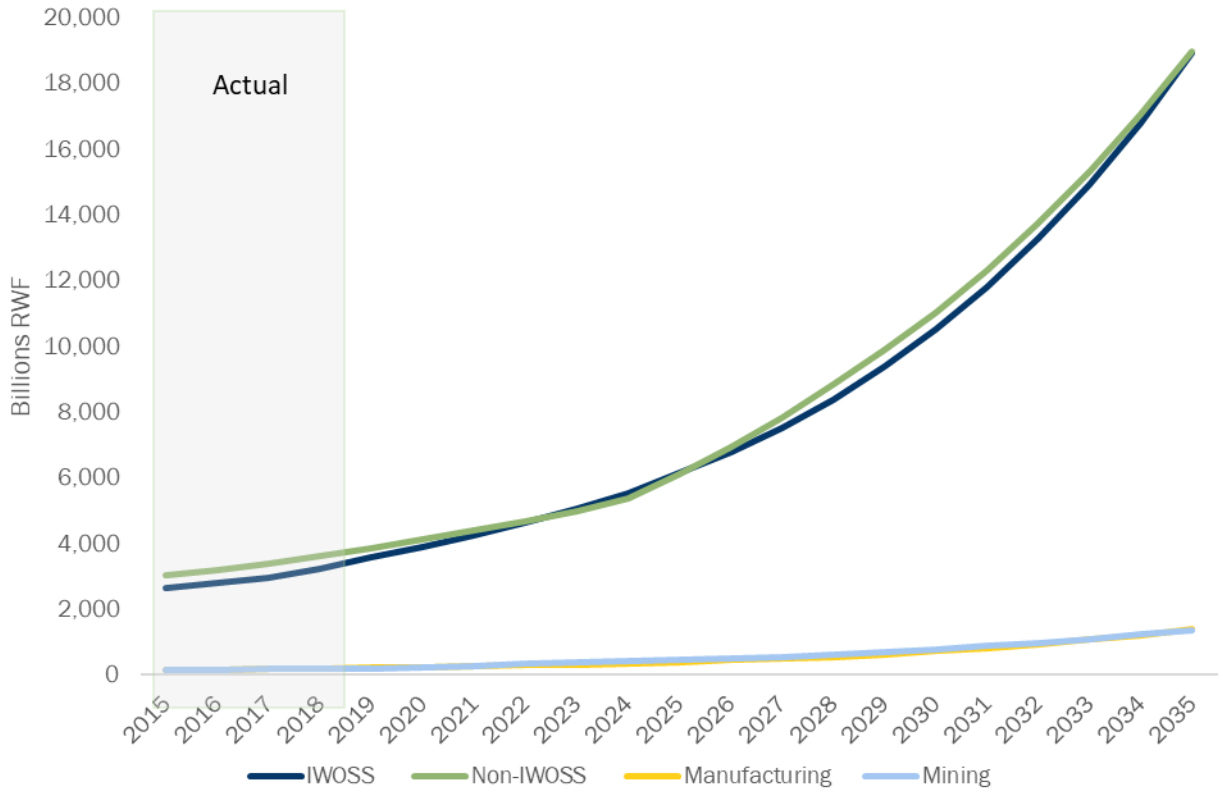
$labor_{s(2017)}$ = Estimated labor force of sector s in 2017

$emp\_elasticity_{s(2035)}$ = Estimates employment elasticity for sector s in 2035

### Rwanda's aspirational growth

Under the government's vision, Rwanda is aiming for a 9 percent annual growth between 2017 and 2020, and 12 percent growth rate between 2024 and 2035. Using these economy-wide estimates together with detailed sectoral growth projections for 2020 to 2022 (projected by the Rwanda Ministry of Finance and Economic Planning), we project GDP growth to 2035 using shares with sector-level adjustments based on historical growth trends and sector-specific development strategies that have the potential to propel and accelerate the growth of certain sectors over the period. Figure A1 shows our predicted growth path for IWOSS and non-IWOSS sectors in which they grow at similar rates.

**Figure A1: Growth projections for 2035**




Source: Rwanda National Accounts, GDP Projections from Ministry of Finance and Economic Planning (MINECOFIN) for 2020-2022, Growth projections for 2035 (under VISION 2050).

After estimating the GDP in 2035, we apply our adjusted employment elasticities to estimate the labor demand in 2035. Two important assumptions are made: first our employment elasticities for 2035 draw on the elasticities for the period 2010-2017 but with adjustments to estimate the employment elasticities in 2035. Second, our labor demand is bound by the projected working-age population in 2032 according to demographic projections by the national statistics agency, estimated at around 9.8 million. This number is approximated to the size of the working-age population in 2035. Assuming full employment, we estimate the sectoral labor demand by sector and by IWOSS vs non-IWOSS sectors.

### Skills distribution of projected labor demand

The next step after calculating the projected labor demand for 2035 is to estimate the skills distribution i.e., the share of high-skilled, skilled, and low-skilled labor demand in 2035. To do so, we look at the change in skill distributions of workers between 2010 and 2017, and we apply that same trend to the period 2017-2035. We define our skill categories using reported education levels in the

EICV. A high-skilled worker has a post-secondary education; a skilled worker has either completed secondary school or has at least had some years of a secondary education; and a low-skilled worker is classified as such if they have completed primary, some primary education, or no formal education. Using Equation 4, we are able to estimate the breakdown of projected labor force for each sector by high skilled, skilled and low skilled.

$$labour_{sv(2035)} = labour_{sv(2017)} + \left(\left(labour_{s(2035)} - labour_{s(2017)}\right) * shr\_labour_{sv(2017)}\right) \quad (4)$$

s= sector (agro-processing, tourism, utilities...) v= high skilled, skilled, low skilled

$labor_{sv(2035)}$ = Projected labor force of sector s in 2035 by skill level v

$labor_{sv(2017)}$ = Projected labor force of sector s in 2017 by skill level v

$shr\_labor_{sv(2017)}$ = Share of difference between sector s labor force in 2017 and 2010 by skill level v

Our projections for skill distribution are applied to the flow of new workers into the economy since there will be very little change to the skill distribution of the existing stock of workers. More specifically, we project the number of workers by skill level to 2035 using the 2010-2017 trend. We then take the additional jobs created in each skill level between 2017 and 2035 and calculate the share of additional workers by skill level (for each sector). This distribution of additional jobs is then applied to the additional jobs created under our labor demand projections for 2035 (i.e., labor demand projections under the aspirational growth scenario limited by the projected working-age population in 2035).

This methodology is in contrast to Bhorat et al. (2019), which projects skill distribution by using the O*NET databases.

### Labor supply estimates

For our purposes, we approximate labor supply in 2035 to the size of the projected working-age population in 2035. The National Institute for Statistics and Research (NISR)'s population projection estimates a working-age population of around 9.8 million. We use that number as our projected labor force for 2035 (in subsequent drafts we will extend the projection to 2035, but for now we use the 2032 numbers in our analysis). Not only do we assume that the economy is at full employment but we also assume that everyone ages 16 and over is available for work. We might want to relax this assumption in the next draft and perhaps use the ratio of the labor force to working-age population to refine our estimates of labor supply.

Since our initial scenario assumes full employment, our sectoral labor supply by sectors is equal to the labor demand by sector.

### Skill distribution of labor supply

To project the skill breakdown of labor supply in 2035, we use skill projections from a joint country study by the Government of Rwanda and the World Bank. Under a "business as usual scenario", 5 percent of the labor supply in 2035 will be high skilled, 35 percent will be skilled and the remaining 60 percent will be low skilled. The numbers are estimated on the current growth rate of school enrolment. Since we cannot project the skill supply by sector, we apply the overall shares of project skill in 2035 across all sectors.

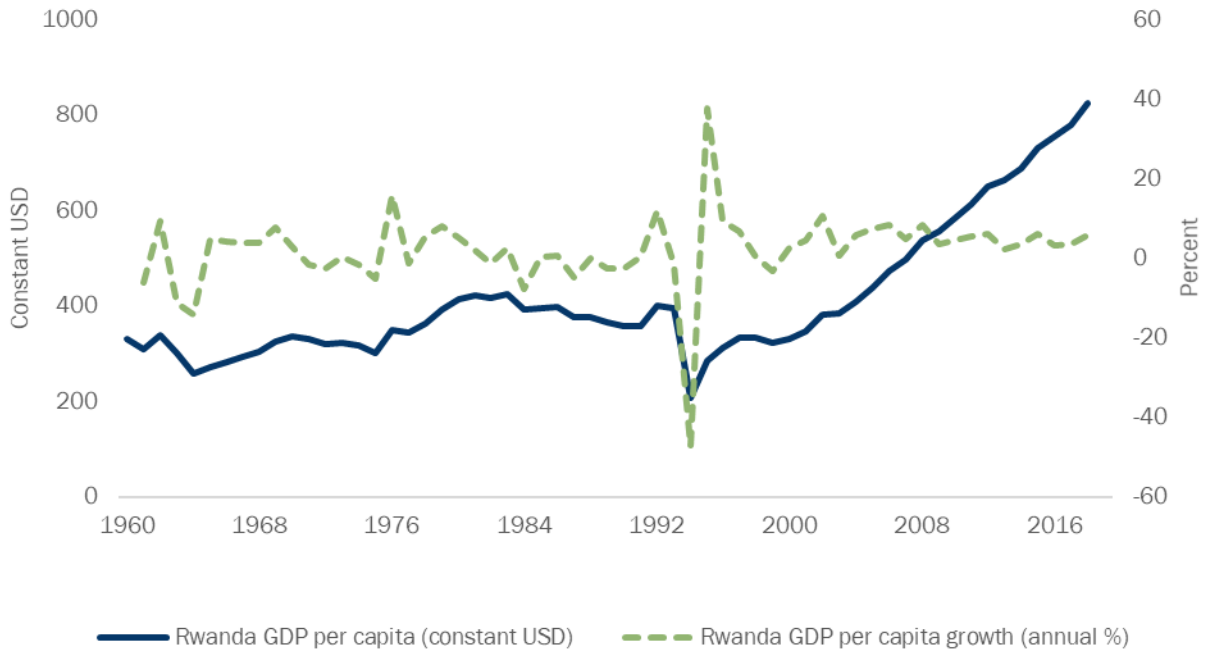
### Skill gap estimates

To estimate the skill gap, we compare our projected labor demand by skill level in 2035 with our projected supply in 2035. We observe a skills gap when there is projected shortage of labor. This is a

first attempt and more work needs to be done to estimate the gap by sector. For each sector, Bhorat et al. (2019) propose using a projected breakdown of labor by occupation code combined with data on the number of years of schooling to estimate by occupation combined with an average number of years of schooling might allow. Occupation distribution would be needed for both labor demand and supply in order to estimate the skills gap.

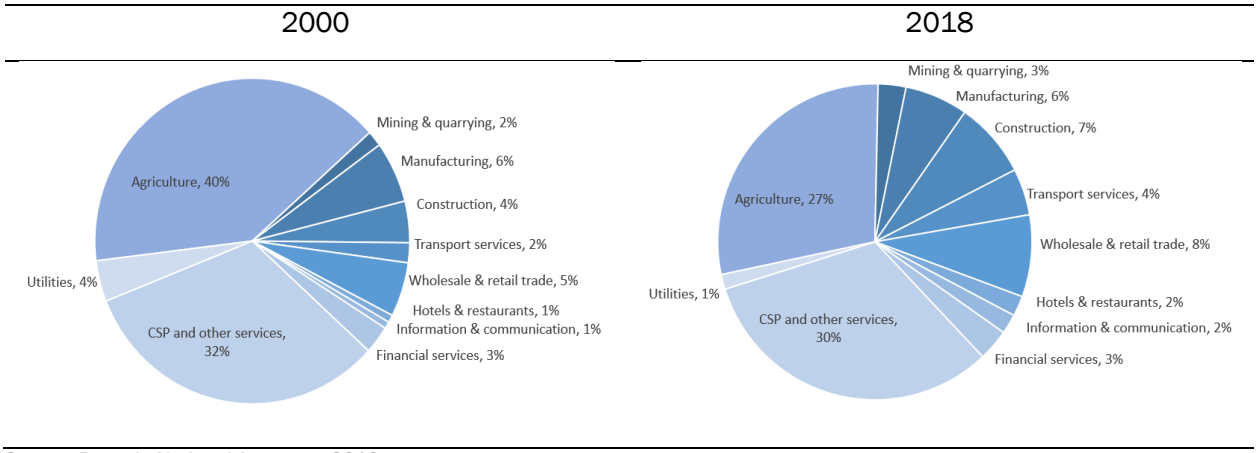
# Annex B. Select supplementary figures and tables

## Figure B1: Evolution of GDP per capita




Source: World Bank Development Indicators, 2019.

## Figure B2: Breakdown of GDP by standard economic sectors




Source: Rwanda National Accounts, 2019.

### Table B1: Employment patterns and salient features, 2000-2017

| | 2000/2001 | 2010/2011 | 2016/20127 |
|---|---|---|---|
| **Labor market aggregates ('000)** | | | |
| Working-age population | 4,118 | 5,888 | 6,756 |
| Employment | 3,571 | 4,783 | 5,825 |
| Narrow unemployment | 59 | 46 | 109 |
| Narrow labor force | 3,630 | 5,006 | 5,934 |
| Discouraged work seekers | - | 4.3 | - |
| **Labor force participation rate (%)** | | | |
| Narrow LFPR | 86.7 | 83.4 | 76 |
| **Unemployment rate (%)** | | | |
| Narrow unemployment rate (all) | 1.6 | 2.2 | 5.3 |
| Narrow unemployment rate (youth) | 2.4 | 3.3 | 7.9 |

Source: Authors' calculations from the Rwanda National Institute of Statistics Integrated Household Survey: 2000, 2010, 2016. Rwanda Labour Force Survey.
Note: Number might not match published numbers because of adjustments made at the time of publication. Details of adjustments are not available for replication.

## Table B2: Employment patterns and salient features, 2019

| | Total | Male | Female | Urban | Rural | Participated in subsistence agriculture | Not participated in subsistence agriculture |
|---|---|---|---|---|---|---|---|
| | ('000) | | | | | ('000) | |
| Population 16 years old and over | 7,231,536 | 3,394,437 | 3,837,100 | 1,479,241 | 5,752,295 | 3,250,836 | 3,980,701 |
| Labor force | 3,862,799 | 2,132,952 | 1,729,847 | 990,547 | 2,872,252 | 1,557,661 | 2,305,138 |
| Employed | 3,273,921 | 1,838,353 | 1,435,568 | 839,040 | 2,434,881 | 1,248,454 | 2,025,467 |
| Unemployed | 588,878 | 294,599 | 294,279 | 151,507 | 437,371 | 309,207 | 279,671 |
| Outside labor force | 3,368,737 | 1,261,485 | 2,107,253 | 488,694 | 2,880,043 | 1,693,175 | 1,675,563 |
| Labor underutilization | 3,009,064 | 1,270,641 | 1,738,423 | 448,714 | 2,560,351 | 1,871,211 | 1,137,854 |
| Unemployed | 588,878 | 294,599 | 294,279 | 151,507 | 437,371 | 309,207 | 279,671 |
| Time-related underemployed | 877,637 | 430,994 | 446,643 | 100,864 | 776,773 | 507,859 | 369,778 |
| Potential labor force | 1,542,549 | 545,048 | 997,501 | 196,343 | 1,346,207 | 1,054,145 | 488,405 |
| Labor force participation rate (%) | 53.4 | 62.8 | 45.1 | 67.0 | 49.9 | 47.9 | 57.9 |
| Employment-to-population ratio (%) | 45.3 | 54.2 | 37.4 | 56.7 | 42.3 | 38.4 | 50.9 |
| Time related underemployment rate (%) | 26.8 | 23.4 | 31.1 | 12.0 | 31.9 | 40.7 | 18.3 |
| LU1 - Unemployment rate (%) | 15.2 | 13.8 | 17.0 | 15.3 | 15.2 | 19.9 | 12.1 |
| LU2 - Combined rate of unemployment and time-related underemployment (%) | 38.0 | 34.0 | 42.8 | 25.5 | 42.3 | 52.5 | 28.2 |
| LU3 - Combined rate of unemployment and potential labor force (%) | 39.4 | 31.4 | 47.4 | 29.3 | 42.3 | 52.2 | 27.5 |
| LU4 - Composite measure of labor underutilization (%) | 55.7 | 47.4 | 63.7 | 37.8 | 60.7 | 71.6 | 40.7 |
| Youth unemployment rate (16-30 yrs) (%) | 19.4 | 16.9 | 22.4 | 19.1 | 19.6 | 26.1 | 16.1 |

Source: National Institute of Statistics (NISR) Rwanda labor Force Survey, 2019

### Table B3: Employment by gender

| Sector | 2017 | | | |
|---|---|---|---|---|
| | Female | Male | Female | Male |
| | ('000) | | (%) | |
| **Overall economy** | **3,051** | **2,775** | **100** | **100** |
| **Total IWOSS** | **266** | **656** | **9** | **24** |
| Export crops and horticulture | 88 | 52 | 3 | 2 |
| Agro-processing | 12 | 23 | 0 | 1 |
| Construction: formal and informal | 36 | 219 | 1 | 8 |
| Tourism | 75 | 83 | 2 | 3 |
| ICT | 3 | 10 | 0 | 0 |
| Transport | 4 | 147 | 0 | 5 |
| Maintenance and repairs | 4 | 32 | 0 | 1 |
| Financial and business services | 12 | 37 | 0 | 1 |
| Trade (excl. tourism): formal | 33 | 54 | 1 | 2 |
| **Manufacturing (excl. agro-processing)** | **31** | **53** | **1** | **2** |
| **Other non-IWOSS** | **2,753** | **2,065** | **90** | **74** |
| Agriculture | 2,427 | 1,499 | 80 | 54 |
| Mining | 6 | 45 | 0 | 2 |
| Utilities | 2 | 9 | 0 | 0 |
| Trade (excl. tourism) informal | 79 | 217 | 3 | 8 |
| Domestic services | 124 | 115 | 4 | 4 |
| Government | 77 | 124 | 3 | 4 |
| Other | 38 | 56 | 1 | 2 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National Accounts.

### Table B4: Labor productivity by sector

| Sector | Labor productivity | | |
|---|---|---|---|
| | 2000/2001 | 2010 | 2017 |
| | (Millions of RWF) | | |
| **Overall economy** | **0.50** | **0.90** | **1.15** |
| **IWOSS** | **4.12** | **3.38** | **3.40** |
| Export crops and horticulture | 0.94 | 1.22 | 1.35 |
| Agro-processing | 16.04 | 30.49 | 6.28 |
| Construction: formal and informal | 2.97 | 1.70 | 1.80 |
| Tourism | 2.26 | 1.25 | 1.95 |
| ICT | - | 8.90 | 9.22 |
| Transport | 1.46 | 1.84 | 1.80 |
| Maintenance and repairs | 0.56 | 2.25 | 0.76 |
| Financial and business services | 28.96 | 44.62 | 25.41 |
| Trade (excl. tourism): formal | 5.98 | 3.22 | 3.41 |
| **Manufacturing (excl. agro-processing)** | **1.56** | **0.96** | **2.06** |
| **Other non-IWOSS** | **0.29** | **0.49** | **0.65** |
| Agriculture | 0.20 | 0.34 | 0.42 |
| Mining | 4.86 | 2.19 | 3.66 |
| Utilities | 17.44 | 6.16 | 8.93 |
| Trade (excl. tourism) informal | 0.49 | 0.46 | 0.66 |
| Domestic services | 0.29 | 0.45 | 0.74 |
| Government | 2.23 | 1.95 | 3.24 |
| Other | 0.84 | 2.52 | 1.89 |

Source: Authors' calculations using EICV1, EICV3, EICV5 and Rwanda National Accounts.
Notes:
1/ Labor productivity is defined as value-added per worker.
2/ Value-added is approximated for sectors not directly reported in the national accounts.
3/ For tourism, export crops and horticulture, value added is estimated using IFPRI (2017).

## Table B5. Demographic characteristics of IWOSS and non-IWOSS workers, 2010-2017

| | Employment share | | | | | | Annual % change | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | | | 2016/2017 | | | 2000 – 2017 | | |
| | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS |
| | ('000) | | | ('000) | | | (%) | | |
| **Total** | **201** | **25** | **3569** | **1185** | **85** | **4556** | **5** | **-3** | **2** |
| By Gender | | | | | | | | | |
| Male | 142 | 14 | 834 | 720 | 53 | 1,873 | 5 | -3 | 2 |
| Female | 59 | 11 | 2,736 | 464 | 31 | 2,683 | 5 | -4 | 2 |
| By Age | | | | | | | | | |
| 16-24 | 3 | 1 | 37 | 277 | 17 | 1,154 | 4 | -8 | 2 |
| 25-34 | 5 | 1 | 38 | 466 | 30 | 1,279 | 6 | -3 | 2 |
| 35-65 | 24 | 2 | 397 | 419 | 36 | 1,825 | 5 | -1 | 2 |
| 65 and over | 169 | 21 | 3,098 | 24 | 3 | 298 | 3 | -2 | 1 |

| | Employment share | | | | | | Annual % change | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | | | 2016/2017 | | | 2000 – 2017 | | |
| | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS |
| | (%) | | | (%) | | | (%) | | |
| **Total** | **5** | **1** | **94** | **20** | **1** | **78** | **5** | **-3** | **2** |
| By Gender | | | | | | | | | |
| Male | 71 | 56 | 23 | 61 | 63 | 41 | 5 | -3 | 2 |
| Female | 29 | 44 | 77 | 39 | 37 | 59 | 5 | -4 | 2 |
| By Age | | | | | | | | | |
| 16-24 | 1 | 4 | 1 | 23 | 20 | 25 | 4 | -8 | 2 |
| 25-34 | 2 | 4 | 1 | 39 | 35 | 28 | 6 | -3 | 2 |
| 35-65 | 12 | 8 | 11 | 35 | 42 | 40 | 5 | -1 | 2 |
| 65 and over | 84 | 84 | 87 | 2 | 3 | 7 | 3 | -2 | 1 |

Source: Authors' calculations from the Rwanda National Institute of Statistics Integrated Household Survey: 2000, 2010, 2016.
Note: Number might not match published numbers because of adjustments made at the time of publication. Details of adjustments are not available for replication

### Table B6: Educational profile of IWOSS and non-IWOSS workers, 2010-2017

| | 2000/2001 | | | 2016/2017 | | | Employment share 2000/2001 | | | Employment share 2016/2017 | | | Annual % change 2000 – 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS | IWOSS | Manu. | Non-IWOSS |
| | ('000) | | | ('000) | | | (%) | | | (%) | | | (%) | | |
| **Total** | **201** | **25** | **3569** | **922** | **85** | **4818** | **100** | **100** | **100** | **100** | **100** | **100** | **9** | **-7** | **-2** |
| **By education** | | | | | | | | | | | | | | | |
| No formal | 181 | 25 | 3563 | 87 | 7 | 934 | 90 | 100 | 100 | 9 | 8 | 19 | -4 | -7 | -7 |
| Less than secondary | 1 | 0 | 6 | 540 | 56 | 3,203 | 0 | 0 | 0 | 59 | 66 | 66 | 42 | 84 | 2 |
| Secondary | 1 | 0 | 0 | 177 | 19 | 563 | 0 | 0 | 0 | 19 | 22 | 12 | 34 | 73 | 109 |
| Post secondary | 1 | 0 | 0 | 37 | 2 | 117 | 0 | 0 | 0 | 4 | 2 | 2 | 20 | 53 | 44 |

Source: Authors' calculations from the Rwanda National Institute of Statistics Integrated Household Survey: 2000, 2010, 2016.
Note: Number might not match published numbers because of adjustments made at the time of publication. Details of adjustments are not available for replication.

**Table B7: Educational attainment by gender, 2000-2017**

| | 2000/2001 | | 2016/2017 | | Share 2000/2001 | | Share 2016/2017 | | Annual % growth 2000 - 2017 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Men | Women | Men | Women | Men | Women | Men | Women | Men | Women |
| | ('000) | | ('000) | | (%) | | (%) | | (%) | |
| Total | 990 | 2,806 | 2,775 | 3,051 | 100 | 100 | 100 | 100 | 6 | 0.5 |
| By education | | | | | | | | | | |
| No formal | 983 | 2,800 | 344 | 622 | 99 | 99 | 12 | 20 | -6 | -8 |
| Less than secondary | 4 | 3 | 1,833 | 1,915 | 0 | 0 | 66 | 63 | 41 | 43 |
| Secondary | 2 | 2 | 432 | 436 | 0 | 0 | 16 | 14 | 36 | 34 |
| Post-secondary | 1 | 1 | 102 | 71 | 0 | 0 | 4 | 2 | 28 | 28 |

Source: Authors' calculations from the Rwanda National Institute of Statistics Integrated Household Survey: 2000, 2010, 2016. Rwanda Labour Force Survey.
Note: Shares do not add up because of unreported education levels.

# Annex C: Comparing employment figures from Integrated Household Survey, 2017 and Rwanda Labor Force Survey, 2017

| | Employment | | | Employment share | |
|---|---|---|---|---|---|
| | 2017 EICV | 2018 RLFS | Difference | 2017 EICV | 2018 RLFS |
| | ('000) | | | (%) | |
| **Total employment** [1,2,3] *(16 and over)* | **5,825** | **3,207** | **-2,618** | **100** | **100** |
| **Total IWOSS** | **922** | **879** | **-44** | **16** | **27** |
| Agro-processing | 35 | 72 | 37 | 1 | 2 |
| Export crops and horticulture | 140 | 77 | -63 | 2 | 2 |
| Tourism | 157 | 79 | -78 | 3 | 2 |
| ICT | 12 | 11 | -1 | 0 | 0 |
| Transport | 151 | 141 | -10 | 3 | 4 |
| Construction: formal and informal | 255 | 325 | 70 | 4 | 10 |
| Maintenance and repairs | 35 | 18 | -17 | 1 | 1 |
| Financial and business services | 49 | 107 | 57 | 1 | 3 |
| Trade (excl. tourism): formal | 86 | 48 | -38 | 1 | 2 |
| **Manufacturing (excl. agro-processing)** | **85** | **57** | **-28** | **1** | **2** |
| **Other non-IWOSS** [4,5] | **4,818** | **2,272** | **-2,546** | **83** | **71** |
| Agriculture | 3,926 | 1,176 | -2,750 | 67 | 37 |
| Mining | 51 | 63 | 12 | 1 | 2 |
| Utilities | 11 | 14 | 4 | 0 | 0 |
| Trade (excl. tourism) informal | 296 | 434 | 138 | 5 | 14 |
| Domestic services | 239 | 225 | -14 | 4 | 7 |
| Government | 202 | 216 | 15 | 3 | 7 |
| Other | 94 | 144 | 50 | 2 | 4 |

Notes:
1/ Numbers might not match published reports. Details of adjustments are not available for replication.
2/ Working age population is defined as 16 years and over by the NISR.
3/ Employment for "export crops and horticlture" and "tourism" are estimated using IFPRI (2017). Employment for ICT are not reported in 2000.
4/ Agriculture includes subsistence agriculture.
5/ Employment in trade(formal and informal) is estimated using ratio's of employment from the Rwanda Establishment Census. As of 2016, the Rwanda National Institute for Statistics (NISR) rolled out a new Labour Force Survey (LFS) to replace employment reporting through the National Household Survey (EICV). The first pilot of the LFS was held in 2016 with surveys done every year after the conclusion of the pilot. For this paper, we use the National Household Survey to allow for a trend analysis from the period 2000-2017. Employment definitions have changed under the LFS. Annex C compares employment numbers between EICV 2017 and LFS 2017. Overall, employment dynamics are similar across both surveys except for the definition of subsistence agriculture