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Rwanda in Global Value Chains

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Introduction

The world economy is increasingly organized through global value chains (GVC) that result from the fragmentation of production processes across countries. A GVC consists of the series of stages involved in producing a product or service that is sold to consumers, with each stage adding value, and with at least two stages carried out in different countries. A firm, country, or region participates in a GVC if it contributes to at least one stage in the production process (Antràs 2020). GVCs reflect the growing interconnection between developed and developing economies, including African countries, despite the continent's apparently low participation in global trade.

Participation in GVCs brings economic benefits in terms of productivity, sophistication, and diversification of exports (Raei et al. 2019; Antràs and De Gortari 2020; De Loecker et al. 2016). The ability to disperse production across borders leads to a sharper international division of labor and more specialization gains (Fort 2017). GVCs allow resources to flow to their most productive use, not only between countries and sectors, but also across production stages within sectors. As

a result, GVCs amplify the effects of traditional trade on growth, employment, and distribution (Antràs 2020). According to the World Bank (2020), a 1 percent increase in GVC participation translates into a 1 percent gain in per capita income. This is five times the gain associated with traditional trade (0.2 percent). Furthermore, some studies find that integration into GVCs decreases poverty more than traditional trade. The World Bank (2020) presents evidence that in Viet Nam, poverty reduction was greater in regions with a higher presence of GVC activity. Thus, GVCs provide various economic benefits to countries. Nonetheless, not all countries or regions, nor all sectors within countries, participate in and benefit equally from GVCs.

This paper presents an overview of Rwanda's GVC participation using an analytical framework introduced by Koopman, Powers, Wang, and Wei (2010 and 2014) for tracing value added by country in international trade. The framework provides a complete decomposition of a country's gross exports into its value-added components, including exports of value added, domestic value added that returns home, foreign value added, and other double-counted terms. These value-added components — expressed as shares of gross exports — are used to measure various dimensions of a country's involvement in global value-added trade, including the strength of a country's backward and forward linkages to GVCs, the intensity of the country's participation in GVCs, and the positioning of the country in GVCs. Using the UNCTAD-Eora GVC database (2019), we apply this analytical framework to Rwanda's trade relationships with the rest of the world, both at the economywide level, where a country's gross aggregate exports are decomposed, and at the sectoral level, where its gross sectoral exports are decomposed.[1] The country-level results are compared with world, continental and regional averages where the region is the Economic Community of Central African States (ECCAS).[2]

The paper is organized as follows. The next section examines Rwanda's GVC participation at the economywide level, exploring the country's backward and forward participation in GVCs and comparing the country outcomes to regional, continental and world averages. The following section looks at sectoral differences in Rwanda's GVC participation, contrasting agriculture with five other key sectors and with the rest of the economy. We then analyze Rwanda's major partners in global value-added trade before concluding.

GVC Participation: Economywide Perspective

Rwanda is involved in global value chains through forward and backward linkages with the rest of the world. The decomposition of Rwanda's gross exports following Koopmans et al. (2010 and 2014) reveals that the country's forward linkages are stronger than its backward linkages (Table 1). Forward linkages — also called forward participation in GVCs — are captured through the country's indirect value-added exports (DVX), that is its domestic value-added exports that are embodied as intermediate inputs in its partner countries' exports. In recent years (2015-2019), Rwanda's forward linkages accounted for 45 percent of its gross exports, slightly above the ECCAS and continental averages of 41 percent and 42 percent, respectively, and significantly above the world average of 30 percent. Backward linkages — also known as backward participation in GVCs — are measured through the relative size of the foreign value added (FVA) incorporated into Rwanda's exports as intermediate inputs used in producing those exports. Between 2015 and 2019, they accounted for 18 percent of gross exports in Rwanda, notably above the regional and continental averages of 8 percent and 15 percent, but below the world average of 30 percent.

1 See methodological details in Odjo and Diallo (2022).
2 ECCAS members include Angola, Burundi, Cameroon, Central African Republic, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Rwanda, and Sao Tome and Principe.

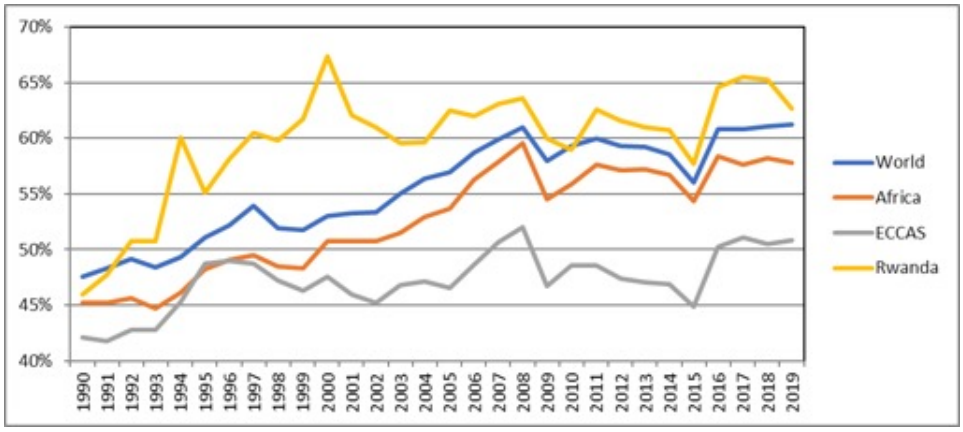
Table 1. GVC participation index in Rwanda, 2006-2019 (percent)

	Forward participation		Backward participation	
	2006-2010	2015-2019	2006-2010	2015-2019
World	29.7	30.0	29.7	30.0
Africa	42.8	41.9	14.1	15.4
ECCAS	42.1	41.4	7.4	8.0
Rwanda	39.2	44.7	22.3	18.4

Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Note: ECCAS = Economic Community of Central African States

The overall GVC participation index value— the sum of forward and backward participation measures — was equal to 63 percent in Rwanda compared to 49 percent in ECCAS, 57 percent at the continental level and 60 percent at the world level. Thus, Rwanda's participation in GVCs is more intensive than the regional, continental, and global average levels. Figure 1 shows that this pattern has been sustained since the 1990s. GVC participation increased over time before stagnating since the 2008 economic and financial crisis.

Figure 1. Trends in GVC participation index in Rwanda compared to ECCAS, Africa and world averages, 1990-2019

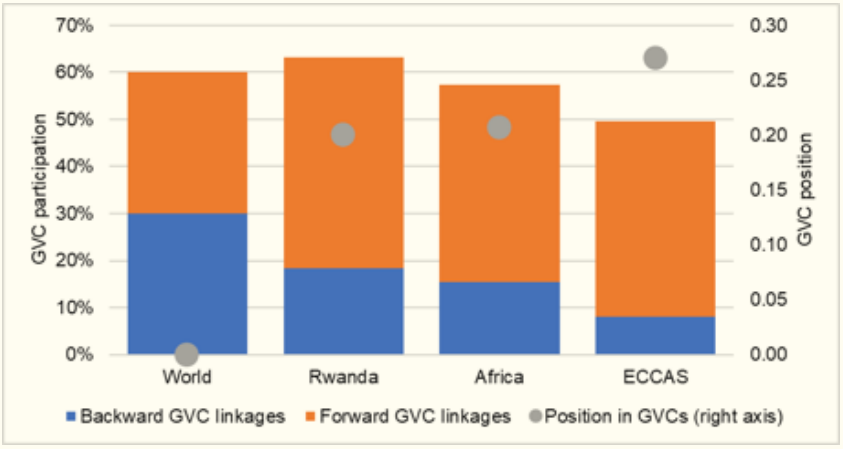


Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Note: ECCAS = Economic Community of Central African States

In Figure 2, Rwanda's position in GVCs is compared to average country positions at the regional and continental levels in 2015-2019. The position or upstreamness of a country's involvement in GVCs is calculated following Koopman et al. (2010) as the log ratio of forward to backward participation indexes.[3] With stronger forward than backward linkages, Rwanda, like the average ECCAS country, is positioned upstream in GVCs, in the sense that the country contributes more value added to other countries' exports than other countries contribute to its exports. However, Rwanda is relatively less upstream than the average ECCAS country. This reflects differences in endowments in natural resources and manufacturing capacities between Rwanda and some of its regional partners. More insights into these differences are sought below through the analysis of sectoral differences, focusing on a comparison of agriculture with other primary sectors and the rest of the economy.

3 More formally, Koopman et al. (2014) suggest to calculate a country's position in a particular GVC as follows: $GVC\ Position\ index = ln\left(1+\frac{DVX}{Gross\ Exports}\right) - ln\left(1+\frac{FVA}{Gross\ Exports}\right)$. By construction, the economywide GVC position index is equal to 0 at the world level, as the sum of DVX is equal to the sum of FVA at that level. As interpreted by Aslam et al. (2017), countries with a larger position index are relatively more upstream, that is, they contribute more value added to other countries' exports than other countries contribute to theirs.

Figure 2. Participation and position in GVCs in Rwanda compared to ECCAS, Africa and world averages, 2015-2019

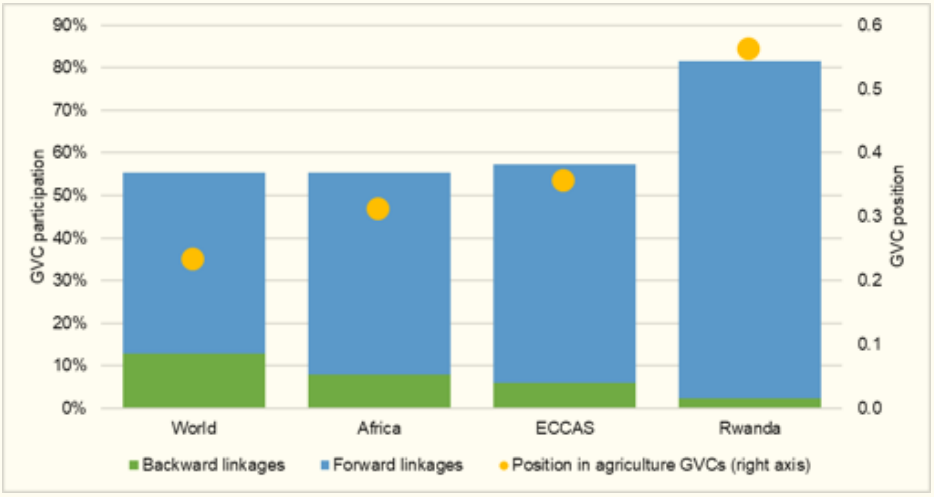


Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Note: ECCAS = Economic Community of Central African States

Sectoral Differences in GVC Participation

Figure 3 depicts the same comparison made in Figure 2 but this time with respect to GVCs in the agriculture sector only, where agriculture includes crop production, livestock, hunting, and forestry. A couple of insights can be derived from comparing the two figures. First, we see that Rwanda's participation in GVCs (the sum of forward and backward linkages) tends to be more intensive in the agriculture sector (Figure 3) than in the economy as a whole (Figure 2). Between 2015 and 2019, participation in economywide GVCs averaged at 63 percent of gross aggregate exports from Rwanda, while participation in agriculture GVCs involved 82 percent of gross agricultural exports from the country. While this pattern is shared by the average GVC participant in ECCAS, it is reversed for the average GVC participant at the continental and world levels. This pattern suggests that agriculture performs better in terms of GVC participation than other sectors of the Rwandan economy.

Figure 3. Participation and position in agriculture GVCs in Rwanda compared to ECCAS, Africa and world averages, 2015-2017



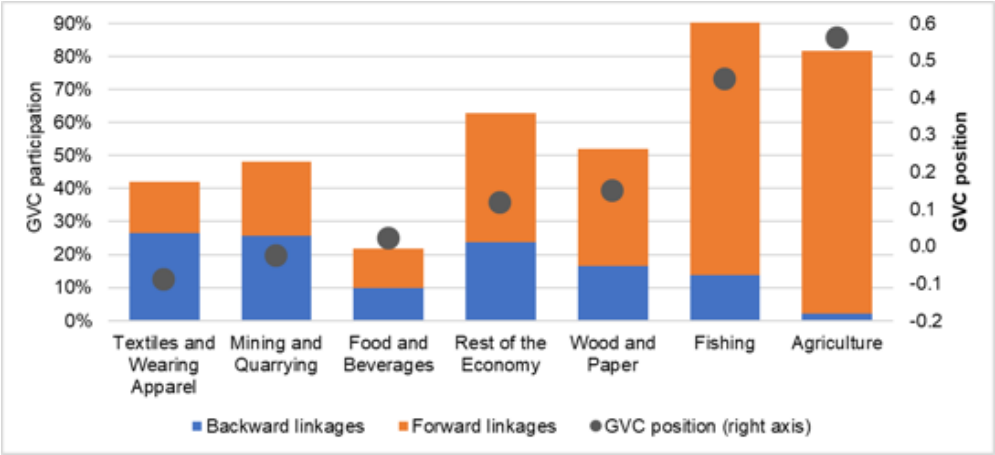
Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Note: ECCAS = Economic Community of Central African States

Second, while forward linkages are stronger than backward linkages in agriculture GVCs at all levels of the analysis, Rwanda's position in agriculture GVCs is more upstream than the regional, continental, and global averages. It is worth recalling that the reverse is observed in Figure 2 where Rwanda appeared less upstream than the regional average with respect to its participation in economywide GVCs. This pattern suggests that some sectors of the Rwandan economy exhibit relatively

stronger backward GVC linkages than agriculture does. We investigate such sectors in Figure 4 below.

Figure 4 shows that Rwanda's participation in agriculture GVCs is relatively more intensive but also more upstream compared to other sectors. The country combines a high participation index with a high position index in agriculture GVCs. This pattern is common to African countries compared to more advanced nations (Odjo and Diallo, 2022). It reflects the predominance of Africa's involvement in agriculture GVCs as an input supplier, rather than a foreign input user, due to poor manufacturing capacities. Though Rwanda's participation in agriculture GVCs is the most upstream of the sectors examined, some other sectors that supply raw products for the production of other countries' exports — the fishing sector and the wood and paper sector — also exhibit more forward than backward linkages. In contrast, Rwanda's involvement in the GVCs of the textiles and wearing apparel sector is significantly less intensive and less upstream. This result applies to other African countries (Odjo and Diallo, 2022). It reflects the fact that Africa's textiles and wearing apparel sector exhibits greater backward GVC linkages, as a user of foreign inputs, than forward linkages, with only a small portion of Africa's exports from this sector further processed outside Africa. The same is observed for Rwanda's involvement in the GVCs related to the food and beverages and the mining and quarrying sectors.

Figure 4. Rwanda's participation and position in GVCs, by sector, 2015-2017

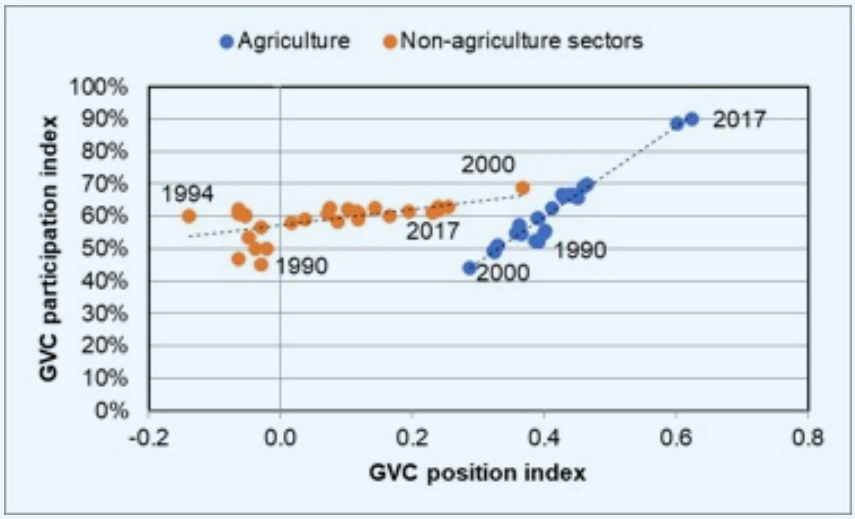


Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)

Note: Agriculture includes crop production, livestock, hunting, and forestry

Figure 5 compares agriculture with the rest of the economy with respect to the evolution of their participation and position in GVCs since 1990. In the figure, each dot represents Rwanda's participation and position in agriculture GVCs and non-agriculture sector GVCs in a particular year from 1990 to 2017. We can see that Rwanda's GVC participation has been increasing faster in agriculture than in non-agriculture sectors. In addition, Rwanda has been moving further upstream in both agriculture and non-agriculture GVCs, most notably in agriculture GVCs. Moving further upstream in agriculture GVCs means intensifying participation as a supplier of unprocessed agricultural products and reaping lower benefits from these GVCs. To benefit more from GVCs, Rwanda needs to upgrade to manufacturing GVCs by incorporating more foreign inputs into its exports to the rest of the world.

Figure 5. Trends in GVC participation and position in agriculture compared to non-agriculture sectors, 1990-2017



Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Note: Agriculture includes crop production, livestock, hunting, and forestry

Rwanda's Major value-added Trade Partners

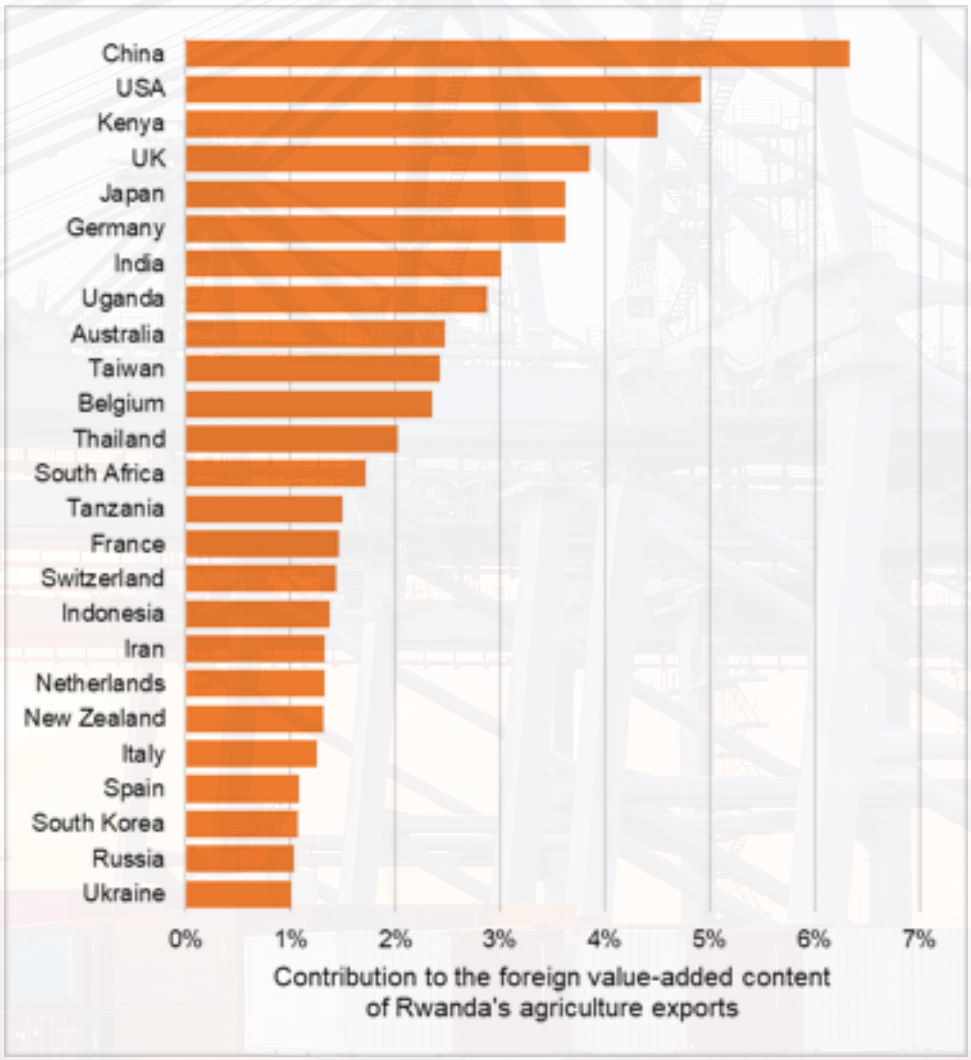
The preceding analysis has demonstrated that Rwanda participates in agriculture GVCs through both backward and forward linkages with the rest of the world. This section examines which countries are Rwanda's main partners in agriculture GVCs, distinguishing between upstream and downstream value-added trade partners.

Major upstream partners

Rwanda's leading upstream partners in agriculture GVCs are depicted in Figure 6. These are countries with which Rwanda exhibited the strongest backward GVC linkages in agriculture in 2015-2017. For instance, 6.3 percent of the foreign value added (FVA) embedded in Rwanda's agricultural exports originated in China while 1 percent was sourced in Ukraine. Together, the 25 partners listed (out of 174 countries ranked) supplied 59 percent of the foreign value-added content of Rwanda's gross agricultural exports. Thus, Figure 6 illustrates Rwanda's exposure to supply chain disruptions in the countries that supply the most agricultural inputs into Rwanda's agriculture exports. Any shock in those partner countries would reverberate downstream to Rwanda at least in the agriculture sector, for example through disruptions in agricultural input supplies. Russia, India, China, and South Africa — four of the five BRICS[4] countries — are among Rwanda's major upstream trade partners, accounting for 12 percent of foreign inputs into Rwanda's agriculture exports. European Union members accounted for 16 percent in 2015-2017. Notably, China accounts for more inputs than each of Africa's most traditional import partners, namely the United States, the United Kingdom, Germany, Belgium, France, the Netherlands, Italy and Spain. Similarly, India is a larger source of intermediate inputs into Rwanda's agriculture exports than Belgium, France, or the Netherlands, and South Africa accounts for more intermediate inputs than France, Switzerland, or the Netherlands. Middle Eastern and Asian countries are also among the list of top input suppliers into Rwanda's agricultural exports. The presence of Russia and Ukraine among Rwanda's major upstream trade partners is noteworthy. It points to Rwanda's exposure to current supply chain disruptions due to the war between these two countries.

4 BRICS is an acronym for the group of five emerging economies, namely Brazil, Russia, India, China, and South Africa.

Figure 6. Rwanda's top 25 upstream partners in agriculture GVCs (2015-2017)



Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Notes: 1. Agriculture includes crop production, livestock, hunting, and forestry. 2. Upstream partners, that is the source countries of the foreign value-added (FVA) content of Rwanda's gross agricultural exports, are not limited to those listed on the horizontal axis. Only the top 25 of 174 upstream partners are listed

Major downstream partners

Rwanda's main downstream partners are depicted in Figure 7. These countries imported the largest shares of the indirect value-added (DVX) content of Rwanda's gross agricultural exports in 2015-2017. In other words, these countries have incorporated the largest shares of Rwanda's agricultural exports as intermediate inputs into their own exports to third countries. For instance, 27 percent of the DVX content of Rwanda's gross agricultural exports are incorporated into the Netherlands' exports to other countries. Together, the 25 countries plotted (out of 174 ranked) embed up to 82 percent of the DVX content of Rwanda's agricultural exports into their own exports. These are countries with which Rwanda has exhibited the strongest forward GVC linkages in agriculture. The top 7 partners — the Netherlands, Germany, Belgium, Italy, France, the United Kingdom, and Russia — are European countries. They incorporate into their own exports 63 percent of the intermediate inputs embodied in Rwanda's gross agriculture exports. China and the United States are the next two major partners, but together they absorb only 4 percent of Rwanda's exports of intermediate inputs.

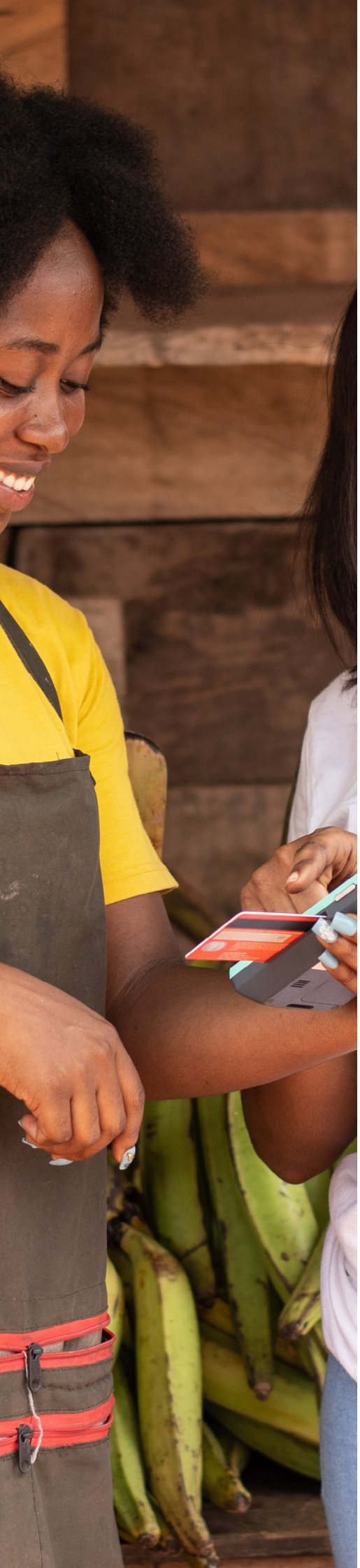
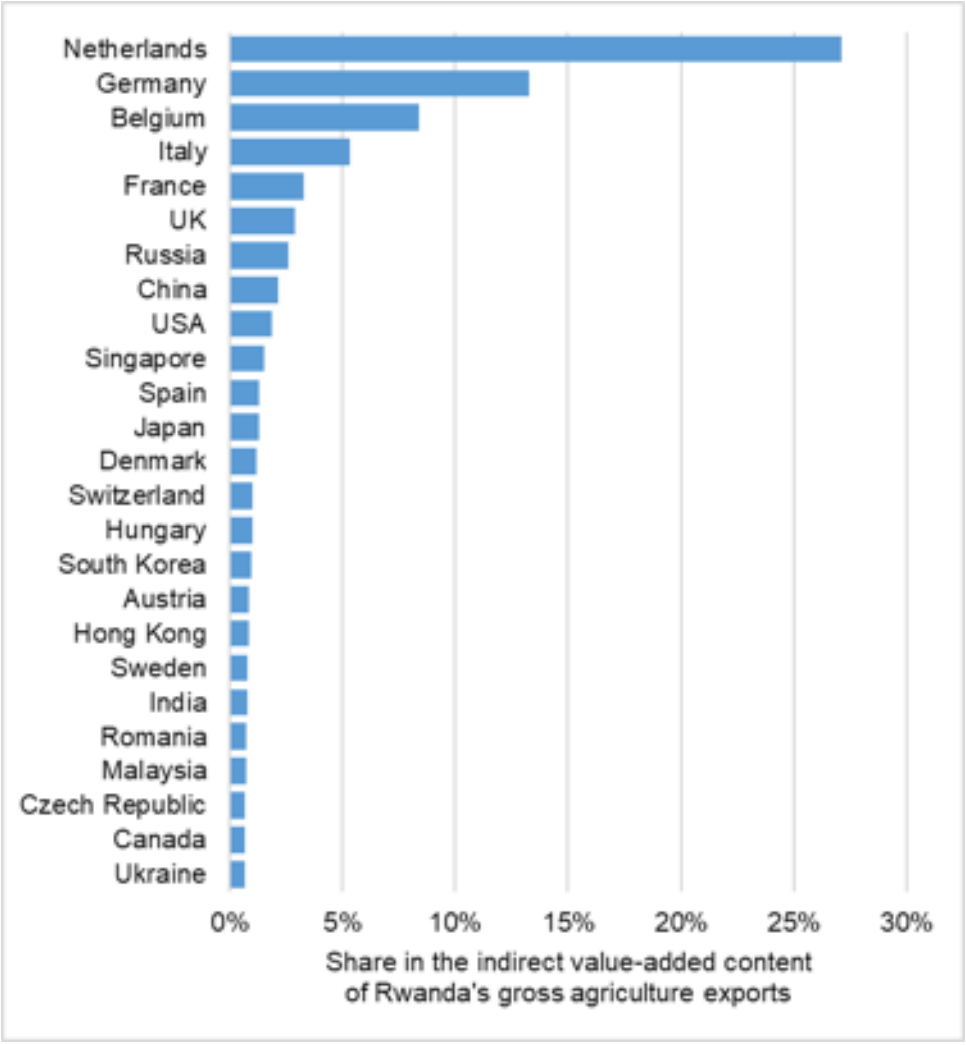


Figure 7. Rwanda's top 25 downstream partners in agriculture GVCs (2015-2017)



Source: Author's calculations based on UNCTAD-Eora GVC Database (2019)
Notes: 1. Agriculture includes crop production, livestock, hunting, and forestry. 2. Downstream partners, that is the countries that absorb the indirect value-added content of Rwanda's gross agricultural exports, are not limited to those listed on the vertical axis. Only the top 25 out of 174 downstream partners are listed

Conclusion

Rwanda's participation and position in GVCs has been the focus of this paper. Over the last decade, Rwanda has intensified its involvement in agriculture GVCs more than in the non-agricultural sector while also moving further upstream over time. The BRICS countries and Western developed countries are Rwanda's major upstream partners, and European countries are its main downstream partners.

These results suggest that Rwanda should broaden its manufacturing sectors in order to upgrade to a more balanced position in agriculture GVCs. Upgrading could take four different forms according to the GVC literature (Humphrey and Schmitz 2002). *Product upgrading* consists in producing higher-quality and more sophisticated products. *Process upgrading* entails reorganizing production processes to improve efficiency and productivity. *Functional upgrading* requires incorporating additional stages of production. *Chain upgrading* refers to diversifying activities into higher-value sectors or end products (Goger et al. 2014; Ahmad and Primi 2017).

Attracting foreign direct investment (FDI) will be the fastest way to raise the capital required to acquire new production and processing technologies. Indeed, FDI can advance technological progress, because multinationals typically introduce superior technology (machines, production procedures, marketing, and management practices) that can spread to local firms. Attracting FDI in turn requires eliminating restrictions in factor markets and improving the country's business climate. The latter includes workforce development, supporting innovation and research and

development (R&D), higher standards, incentives for firms targeting upgrading, reducing logistical costs, infrastructure, and special economic zones. The country must also improve its human resources for the management of local small and medium enterprises and seize the opportunity offered by the large domestic market created by the African Continental Free Trade Area (AfCFTA). Successful implementation of the AfCFTA can facilitate the broadening of the manufacturing sector that would lead to a more balanced position in GVCs. Indeed, strengthening regional value chain integration through the AfCFTA will help African countries participate more effectively in GVCs. Improving regional integration is the best way to make Africa a more dynamic and competitive region capable of driving the process of GVC development.

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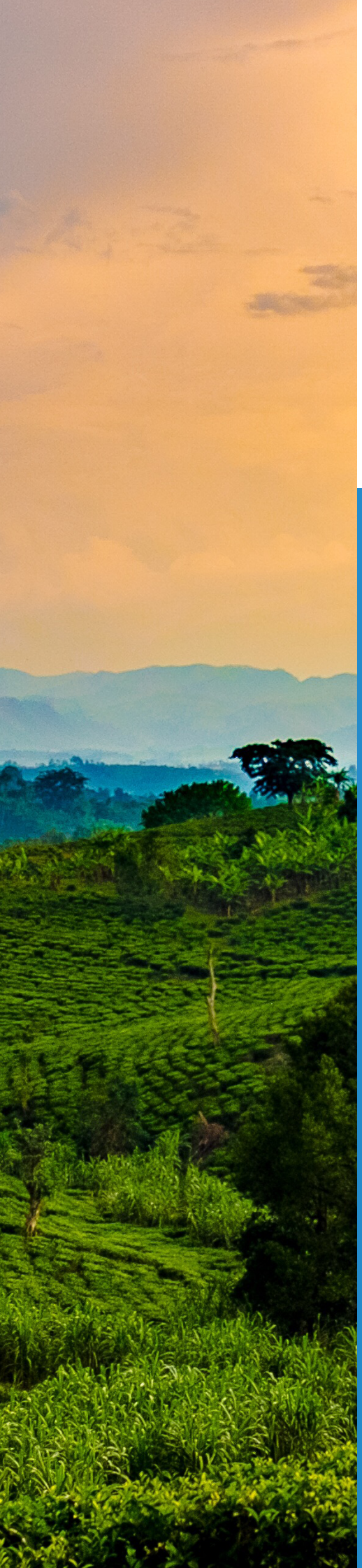

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