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

A Senegal case study

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Abstract

In this paper, we analyze specific “industries without smokestacks” and their potential contribution to economic growth and job creation in Senegal. Our main finding is that this potential is huge and can be further leveraged by adopting certain policies, both in terms of sectoral reforms and encouraging investments to improve the business environment. Moreover, in doing so, resulting IWOSS growth might further increase the growth trajectory of Senegal in the near future. It would also dramatically increase the number of high-quality jobs that also correspond to a higher level of skills. Our findings, based on assumptions regarding minor reforms to be undertaken by the government in some critical areas of private sector development policy, project that, by 2035, a total of 10,985,000 new jobs will be created in the Senegalese economy. The number of IWOSS is estimated to be as high as 7,435,000, which is roughly two-thirds of total new jobs. Moreover, these IWOSS jobs, which are higher-productivity, are likely to be better quality-jobs than the others. To fully realize the potential of IWOSS to facilitate structural transformation, government will have to address some key constraints. Such policies should aim to remove the many hurdles that exist in Senegal’s regulatory framework and deter private enterprise development, including: a) highly rigid labor regulations; b) a cumbersome and costly tax system; c) a still-inhibiting importing system; d) a weak judicial system and poor contract enforcement environment; and e) infrastructural deficiencies in areas like electricity, transportation, and telecommunications, etc. Our study also underscores significant skills gaps—in terms of hard, digital, and soft skills, that will need to be addressed in order to encourage such transformation.

Contents

1. Introduction	1
2. Country context and background	2
3. Sectoral decomposition: IWOSS in comparative perspective with non-IWOSS	6
4. Constraints to IWOSS growth.....	11
5. A value-chain analysis of industries without smokestacks in Senegal.....	14
6. Future trends: Potential growth and labor demand.....	19
7. Firm survey results	23
8. Policy implications: Unlocking growth potential and overcoming skills gaps.....	29
9. Conclusion	30
References	31
Appendix A: Data sources.....	33

List of tables

Table 1: Employment patterns and salient features, 2001-2017.....	3
Table 2: Changes in employment and employment share in IWOSS and non-IWOSS (2001-2017)	4
Table 3: Ratio of sectoral labor productivity to average productivity	5
Table 4: Employment-output elasticity for Senegal	9
Table 5: Demographics of IWOSS and non-IWOSS workers, 2001-2017	10
Table 6: Breakdown of sectoral employment by skill level, 2017	10
Table 7: Projected GDP and labor demand.....	19
Table 8: Projected labor demand by skill level	20
Table 9: Sectoral skills gap in IWOSS	21
Table 10: Sectoral skills gap in non-IWOSS	21
Table 11: The occupational skills gap for selected occupations in horticulture.....	22
Table 12: The occupational skills gap for selected occupations in tourism	22
Table 13: The occupational skills gap for selected occupations in agro-processing	22
Table 14: Main occupations for youth (15-24 years) in agro-processing firms	23
Table 15: Importance of relevant skills required for main youth occupations identified in the agro-processing sector.....	24
Table 16: Main occupations for youth (15-24 years) in the tourism sector.....	24
Table 17: Importance of relevant skills required for main youth occupations identified in the tourism sector	25
Table 18: Main occupations for youth (15-24 years) in horticultural firms	25
Table 19: Importance of relevant skills required for main youth occupations identified in horticultural sector	25
Table 20: Importance of skills required for main youth occupations identified in the agro-processing sector	27
Table 21: Importance of hard and soft skills required for youth occupations in the agro-processing sector	27
Table 22: Importance of skills required for main youth occupations in the tourism sector	27
Table 23: Importance of hardh and soft skills required for youth occupations in the tourism sector	28
Table 24: Importance of skills required for main youth occupations in the horticultural sector.....	28
Table 25: Importance of hardh and soft skills required for youth occupations in the horticultural sector	28
Table 26: Skills deficit by sector	29

List of figures

Figure 1: Real GDP per capita values and growth rates.....	2
Figure 2: Contribution to GDP by sector between 2001 and 2017.....	4
Figure 3: Correlation between sectoral productivity and change in employment in Senegal, 2010-2017	6
Figure 4: Evolution of value-added and employment in the tourism sector	7
Figure 5: Value-added and employment growth for tourism.....	7
Figure 6: Evolution of value-added and employment in agro-processing	8
Figure 7: Evolution of value-added and employment in horticulture.....	8
Figure 8: Evolution of value-added and employment in manufacturing	9
Figure 9: Senegal: Ease of doing business score	11
Figure 10: Most problematic factors for importing in Senegal	12
Figure 11: Value chain of the horticulture sub-sector in Senegal	15
Figure 12: Senegal's share of world exports of groundnuts and groundnut oil (%)	18
Figure 13: Projection of the number of jobs (2017-2035)	19

1. Introduction

In recent years, high youth unemployment has become the most pressing challenge facing African policymakers. While in 2014 the unemployment rate for young people (aged 15 to 24) in the developing world, reached 13 percent—almost three times that for other adults. In Africa, this troubling trend is compounded by the fact that the proportion of the young population is much higher than anywhere else. In fact, half of Africans are under the age of 18, compared to the estimated global median age of around 28 years old, and above 40 years old in many rich countries. As a result, in the coming years, the demand for employment will remain very high, and the employment-related problems will be even more worrying in Africa. While in East Asian countries, the development of the manufacturing sector allowed economies to absorb a significant share of low-skilled and unskilled job seekers, African economies remain characterized by a dwindling manufacturing sector that is very far from being able to absorb its growing young population.

Unlike in industrialized and emerging economies, export-led manufacturing is playing a much smaller role in the structural transformation of Africa's economies. Indeed, while the share of manufacturing in Africa's GDP has fallen, on average, since 1980, services absorb the bulk of African workers leaving agriculture and moving to cities. Senegal is no exception to this trend. While agriculture has lost more than 10 percentage points of its labor share between 2004 and 2019, manufacturing has increased its share by only one percentage point, against 7.6 percentage points for trade. The growing working-age population has almost entirely been absorbed into the informal sector, in particular, agriculture and especially informal services in urban areas. Senegal, therefore, displays similar patterns of structural transformation as other African countries where growth has failed to relocate resources from agriculture to manufacturing.

A growing body of literature identifies some sectors that are similar to manufacturing in many regards, and that could be nurtured to support economic growth and generate employment (Page, 2019). These industries called “industries without smokestacks” are characterized by (i) being tradeable, (ii) generating high value-added per worker, (iii) having a greater potential for technological change and productivity growth, and (iv) showing evidence of scale and/or agglomeration economies. Newfarmer and al. (2018) highlight four industries without smokestacks that have become increasingly dominant sectors in Africa: agro-industry and horticulture, tourism, business services (including information and communications technology (ICT)-based services), and transport and logistics. These industries' growth and ability to absorb low-skilled labor present an opportunity for African economies to address high and growing rates of unemployment among the youth in particular (Bhorat et al., 2019).

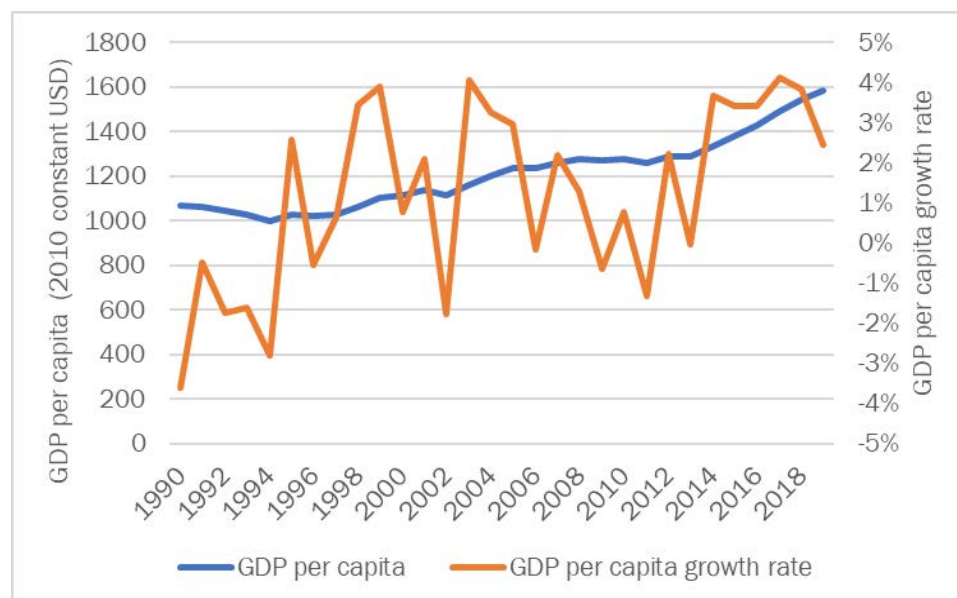
In this report, we use Senegal as a case study to assess the employment potential of industries without smokestacks (IWOSS), identify labor skills requirements and skills gaps for such industries, as well as constraints to their growth and policy responses to ease them. In doing so, we focus on horticulture, tourism, and agrobusiness, which, among all IWOSS sectors, manifest higher potential for growth and job creation in Senegal, (Golub et al., 2019). The remainder of the document is organized as follows: Section 2 provides some background information on Senegal. Section 3 discusses the pattern of growth in Senegal, focusing on IWOSS. Section 4 presents the results of sectoral productivity and job decomposition, comparing IWOSS and non-IWOSS sectors. Section 5 identifies constraints to IWOSS growth, in particular through a value-chain analysis. Section 6 estimates future trends in potential growth and labor demand. Section 7 presents our firm survey results. Section 8 concludes and explores the policy implications of previous sections on how to unlock growth potential and overcome skills gaps for IWOSS.

2. Country context and background

With “three major peaceful political transitions since its independence in 1960” (World Bank, 2019b) and a total population of nearly 16 million, Senegal is one of Africa’s most stable countries. In 2014, the Government of Senegal launched the Emerging Senegal Plan (PSE in French acronym), with the aim to increase the well-being and prosperity of the Senegalese populations by 2035. The PSE is divided into three strategic axes, including: (i) structural transformation of the economy and growth, which aims at the sustainable creation of wealth and the eradication of poverty in all its forms, (ii) human capital, social protection, and sustainable development; and (iii) governance, institutions, peace, and security. Recent macroeconomic trends reveal that PSE is showing some signs of success as Senegal’s economic growth has averaged at 6.6 percent over the 2014-2019 period, contrasting with only 3 percent on the period 2009-2013. Projections estimate that the same high economic growth will be observed in the upcoming years especially with the newly discovered oil and gas reserves (World Bank, 2019b). Growth is mainly driven by contributions from consumption (3.5 percent) and private investment (2.1 percent). It has mainly benefited from three main drivers: agriculture, boosted by support programs, robust external demand, and large investments in infrastructure. This growth also remains characterized by a high level of debt, which went from 60.6 percent of GDP in 2017 to 64.5 percent in 2018, taking into account state-owned enterprises and parastatals. However, the issue of inclusion remains critical, as current job creation has been insufficient in absorbing internal migratory flows or the growing working-age population—especially since employment is mainly informal, resulting in low wages, underemployment, and limited social protections.

Figure 1 depicts the Senegal’s GDP per capita and related growth rate between 1990 and 2019. Overall, the growth rate in the country’s GDP per capita was erratic until around 2014. Relatedly, GDP per capita has started recovering from its low levels of the 1990s in 2015, before plummeting again in 2018.

Figure 1: Real GDP per capita values and growth rates



Source: World Bank, World Development Indicators, 2019 and authors’ calculations.

The unemployment rate in Senegal considerably decreased from 11 percent to 6 percent between 2011 and 2018 (Macrotrends, 2019). According to the World Bank, 90 percent of non-agricultural

employment in Senegal are in the informal sector. Furthermore, youth¹ unemployment is relatively high in Senegal even though some progress has been observed in the past decade. For instance, youth unemployment dropped from 14 percent to 6 percent between 2007 and 2016. Similarly, Senegal has been successful in closing the gender gap in employment: In fact, the difference between the unemployment rates of men and women was around 6 percentage points in 2007 and went down to almost 0 in 2016 (Golub et al., 2019a).

Like in many other African countries, the supply of potential workers is high in Senegal, while the number of jobs is often very limited. Between 2001 and 2017, labor force has grown by close to 2,400,000 people in absolute terms, which corresponds to an annual growth rate of 3.41 percent for narrow labor force (Table 1). Table 1 also shows the breakdown of unemployment by age group, revealing higher unemployment rates among youth. In 2017, youth (15-24) unemployment was at 7.82 percent, contrasting with 6.6 percent for older people. While the annual employment growth rate was high (over 4.21 percent of the narrow labor force) between 2001-2017, it is worth noting that most of those jobs are low-quality jobs. Official statistics show that total number of employees with social benefits, health coverage, and retirement plans peaked at 435,000 in 2019 (Golub et al., 2019a), about 10 percent of existing jobs at that time.

Table 1: Employment patterns and salient features, 2001-2017

	2001	2017	Absolute change	Annualized change (%)
Labor market aggregates				
Population 15+	5,567,662	8,752,688	3,185,026	2.87
Employment	3,351,679	5,443,900	2,092,221	3.08
Narrow unemployment	198,828	384,687	185,858	4.21
Narrow labor force	3,550,508	5,828,587	2,278,079	3.15
Discouraged work seekers	250,660	394,052	143,392	2.87
Labor force participation rate (%)				
Narrow LFPR	63.77	66.59	2.82	0.27
Unemployment rate (%)				
Narrow unemployment rate (all)	5.6	6.60	1.00	1.03
Narrow unemployment rate (youth)	8.54	7.82	-0.72	-0.55
Expanded unemployment rate (all)	11.83	12.51	0.69	0.35
Expanded unemployment rate (youth)	14.36	15.39	1.02	0.43

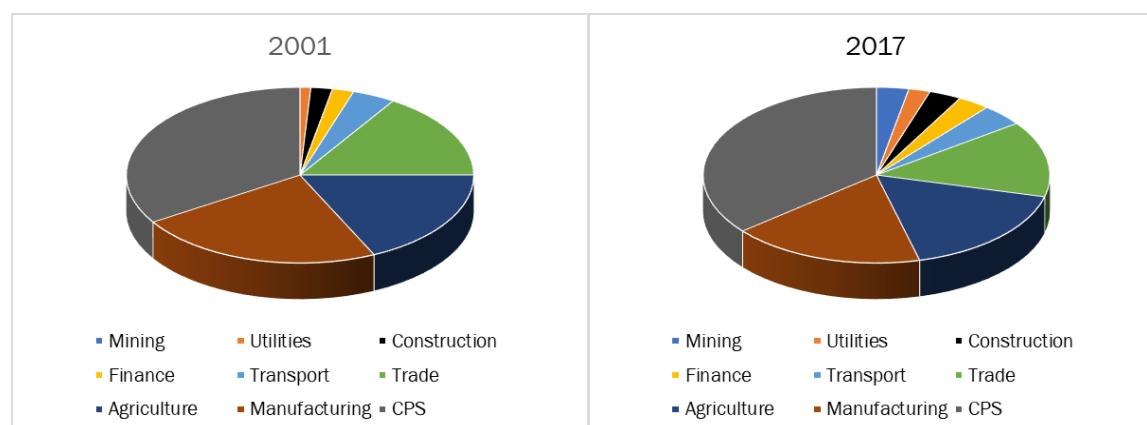
Source: ANSD, ENES, ESAM, ILOSTAT, 2020; authors' calculations.

Note: See Borat et al. (2021) for the definition of these concepts.

Growth in Senegal, as in many other African countries, has been mainly jobless, as the creation of good jobs has failed to keep pace with the vibrant dynamics of labor supply, as shown in previous sections. Three main explanations can be given to the mediocre job creation performances Low-productivity agriculture which has seen its value-added shrink from 18 percent in 2001 to 17 percent in 2017 (Figure 2):

- At the same time, mining, which is known to be very capital-intensive, has increased its share of GDP from close to 0 in 2001 to 3 percent in 2017.
- Finally, manufacturing, which is generally considered an important reservoir of labor, has decreased as a share of GDP from 23 percent in 2001 to 17 percent in 2017.

¹ Youth is herein defined as individuals aged between 15 and 24.

Figure 2: Contribution to GDP by sector between 2001 and 2017


Source: ANSD, 2019, Comptabilité nationale and authors' calculations.

When comparing these trends with those observed around employment (Table 2), important contrasting patterns emerge:

- While, between 2001 and 2017, mining has significantly increased its share of total value-added, its share in total employment has remained marginal at around 1 percent.
- Trade, which has a slightly declining share of GDP, has increased its share of total employment, between 2001 and 2017, when considering both formal and informal trade.
- Manufacturing has lost 0.3 percentage points in its share of total employment, and its share of GDP has slightly decreased by 5 percent.

Furthermore, both Table 3 and Figure 3, show that, between 2001 and 2017, structural transformation was limited. Agriculture is losing employment share to other sectors, while also experiencing slower-than-average growth in labor productivity. For manufacturing, we observe a decrease in its relative productivity growth, while its share in employment is slightly increasing. The trade sector experiences a decrease in relative productivity, contrasting with its increasing share in employment. Mining has one of the highest ratios of sectoral to total productivity, but almost a stagnant share of employment over the sample period.

Table 2: Changes in employment and employment share in IWOSS and non-IWOSS (2001-2017)

	Employment		Employment share	Annual growth		
	2001 Absolute ('000)	2017	Change (%)	2001	2017	2001-2017 %
Total employment	3,351	5,443	62.4	100.0	100.0	3.1
Total IWOSS	610	1,234	102.2	18.2	22.7	4.5
Agro-processing	200	367	83.6	6.0	6.7	3.9
Horticulture	63	209	231.7	1.9	3.8	7.8
Tourism	223	446	100.0	6.7	8.2	4.4
ICT	22	33	52.9	0.6	0.6	2.7
Transport	26	35	32.5	0.8	0.6	1.8
Financial and business services	3	12	289.6	0.1	0.2	8.9
Trade: formal	15	40	160.6	0.5	0.7	6.2
Other IWOSS services	58	92	59.1	1.7	1.7	2.9
Manufacturing	189	324	71.1	5.6	5.9	3.4

Other non-IWOSS	2,552	3,886	52.3	76.1	71.4	2.7
Agriculture	1,675	2,182	30.3	50.0	40.1	1.7
Mining	32	62	93.8	1.0	1.1	4.2
Utilities	27	38	40.7	0.8	0.7	2.2
Construction	64	134	109.4	1.9	2.5	4.7
Trade: informal	269	701	160.6	8.0	12.9	6.2
Government	39	61	53.7	1.2	1.1	2.7
Other non-IWOSS services	445	708	59.1	13.3	13.0	2.9

Note: Other IWOSS services include: real estate, specialized scientific and technical activities, support service activities. Other non-IWOSS services include: education, human health, social work, art, culture, sports, and recreational activities, services not classified elsewhere, and informal finance.

Source: ANSD (2019); authors' calculations.

Table 3: Ratio of sectoral labor productivity to average productivity

	2000	2010	2017
Total IWOSS	2.51	2.15	2.17
Agro-processing	1.69	0.93	1.17
Horticulture	2.62	1.61	1.75
Tourism	1.44	1.12	1.02
ICT	2.96	8.05	7.62
Transport	1.92	2.58	3.50
Financial and business services	12.63	11.20	10.77
Trade: formal	8.08	5.01	4.45
Other IWOSS services	7.40	7.42	8.19
Manufacturing	1.58	1.73	1.41
Other non-IWOSS	0.57	0.59	0.55
Agriculture	0.33	0.36	0.37
Mining	-	2.82	2.37
Utilities	1.19	2.08	3.09
Construction	0.95	0.47	1.14
Trade: informal	1.30	0.81	0.78
Government	3.61	4.14	4.81
Other non-IWOSS services	1.41	1.30	0.81

Note: Other IWOSS services include: real estate, specialized scientific and technical activities, support service activities. Other non-IWOSS services include: education, human health, social work, art, culture, sports, and recreational activities, services not classified elsewhere, and informal finance.

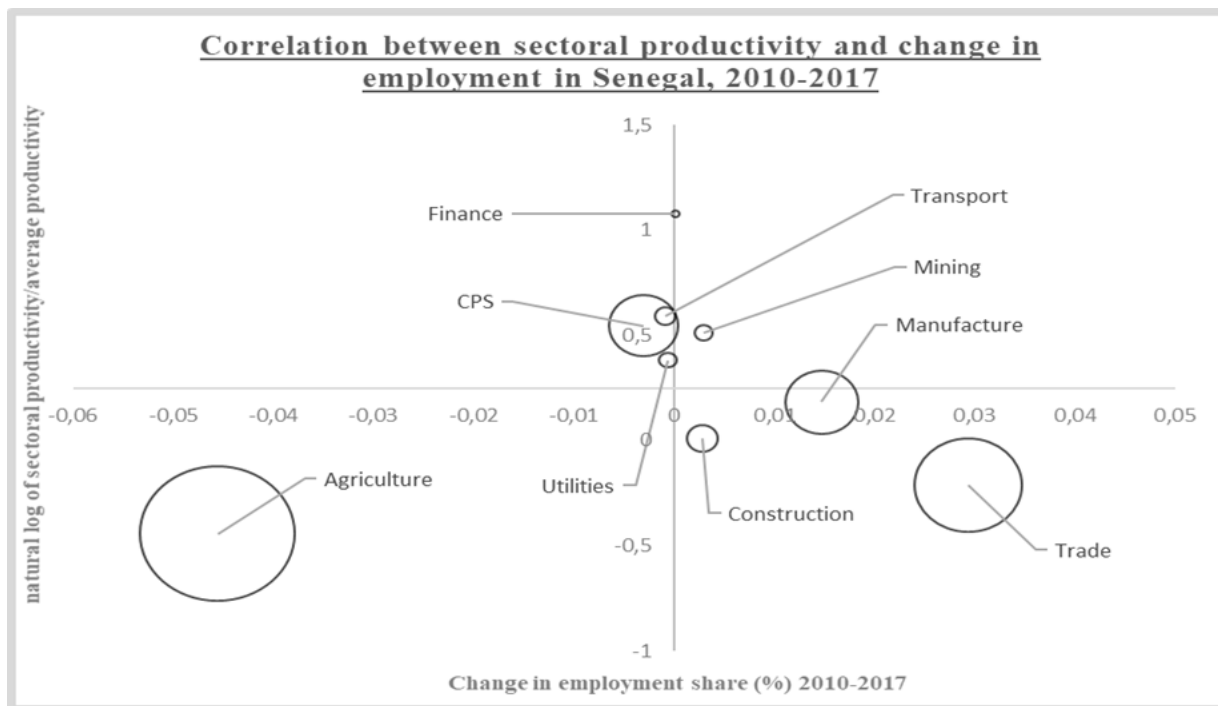
Source: ANSD (2019), Direction de l'horticulture; authors' calculations.

All these trends suggest a clear absence of any movement of labor from agriculture to manufacturing. By contrast, IWOSS, unlike manufacturing, has recorded higher-than-average increases in both productivity and employment share. While this finding lends support to the mainstream literature on lack of manufacturing-driven structural transformation and premature deindustrialization, it also depicts a clear pattern in which IWOSS sectors absorb a significant share of the labor leaving agriculture. IWOSS are found to be similar to manufacturing in many regards, including that they are tradeable, have the capacity for learning and productivity growth, can absorb large numbers of un- or moderately skilled labor, and often exhibit scale and agglomeration economies (Newfarmer, et al., 2018). Such sectors include: horticulture, agri-business, IT-based transport, formal trade, commercial agriculture, and tourism.

In several parts of the world, tourism plays an important role in stimulating economic growth. At a global level, the tourism sector employs 277 million people and accounts for nearly 10 percent of global GDP (Page, 2019). Southern and East African countries have already experienced the sector's huge potential in creating jobs and boosting economies. Senegal, with its pristine beaches, has high potential for developing a vibrant tourism sector which, as of now, is struggling. Horticulture also offers promises for growth: With technological advancements, fresh vegetables and flowers that used to be

produced for local consumption can now be transported and sold globally (Page, 2019). ICT services are also significant employment providers given the globalized nature of economies, which requires connectivity. Finally, the agro-processing sector, which encompasses sub-sectors like food and beverages, also holds large potential for growth under the new African Continental Free Trade Area (AfCFTA), and thus is a great opportunity for creating jobs and boosting exports.

Figure 3: Correlation between sectoral productivity and change in employment in Senegal, 2010-2017



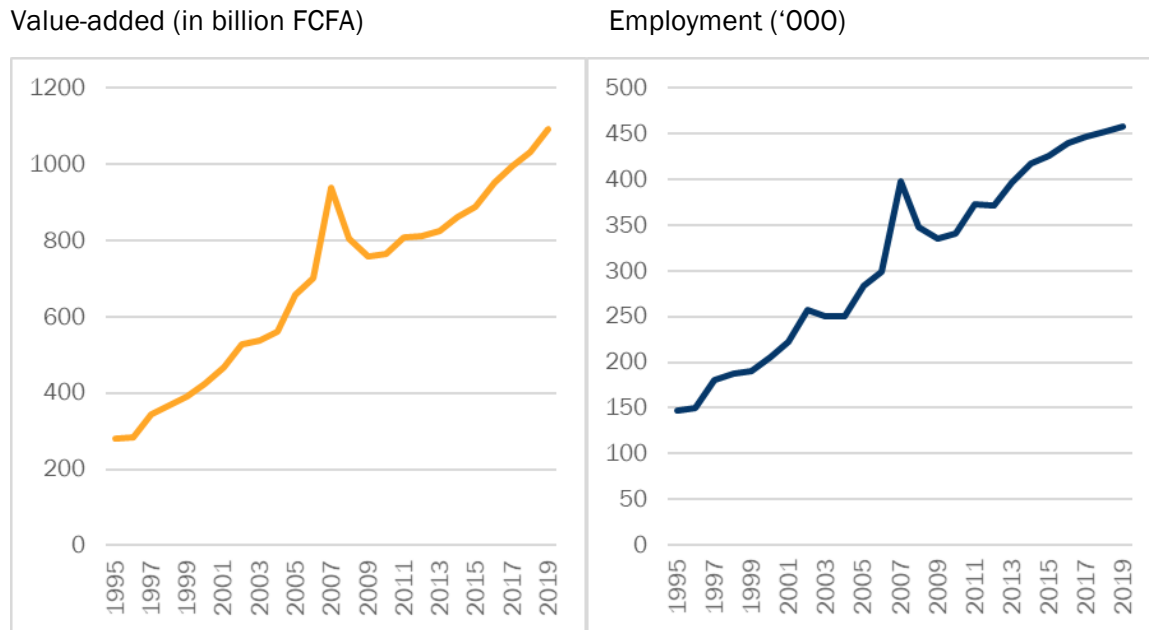
Source: ANSD (2019) and authors' calculations.

3. Sectoral decomposition: IWOSS in comparative perspective with non-IWOSS

In Senegal, industries without smokestack have the potential, which, if properly leveraged, can dramatically boost good-quality job creation. Already, some industries without smokestacks, namely horticulture and tourism, are doing well in terms of output growth (Figures 4-8). Between 1999 and 2019, horticulture increased its value-added more than four times. Manufacturing's increased only 2.7 times, which is also slightly lesser than tourism's 2.8 times. By contrast, agri-business has performed particularly poorly over sample period, with its sub-sectors (mainly food and beverages) performing worse than manufacturing. This poor growth could be explained by the fact that most of them bear the burden of the same costs associated with manufacturing's inability to grow. For example, while labor regulations are particularly stringent for all industries in Senegal, collective bargaining applicable to manufacturing—and, consequently, agro-processing—has made those regulations even more stringent than in other IWOSS sectors. Likewise, costs of financing, which are subsidized for agriculture (and, therefore, horticulture) are far lower than that of manufacturing, where there is no preferential financing.

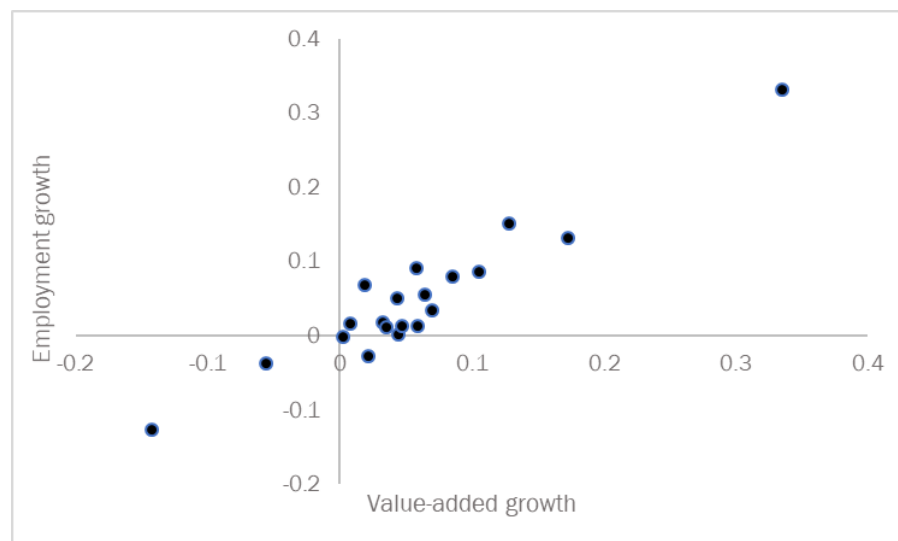
To compare IWOSS job creation against that of non-IWOSS, we compare trends in employment increases with those of value-added increases for each sector (Figures 4, 6, 7, 8). Likewise, table 4 compares employment elasticities for IWOSS and non-IWOSS sectors. While for agro-processing, the point-elasticity is 0.88, it reaches 0.97 for horticulture and 0.96 for tourism. When considering overall IWOSS sectors, the employment elasticity, which stands at 0.77 is higher than that of the manufacturing and non-IWOSS sectors with respective ratios of 0.54 and 0.48. These results confirm Page (2019)'s assertion that, should the bottlenecks on IWOSS be removed, they have a much greater potential to foster job creation than other sectors.

Figure 4: Evolution of value-added and employment in the tourism sector



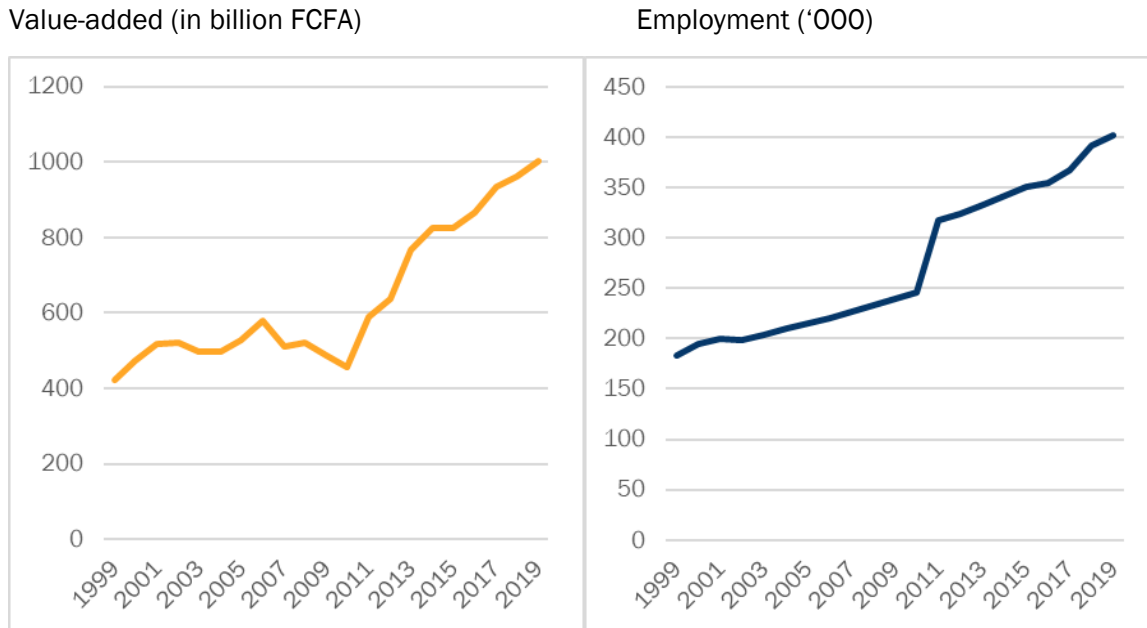
Source: WTTC Data Gateway, 2019.
 Note: 538 FCFA = 1 USD.

Figure 5: Value-added and employment growth for tourism



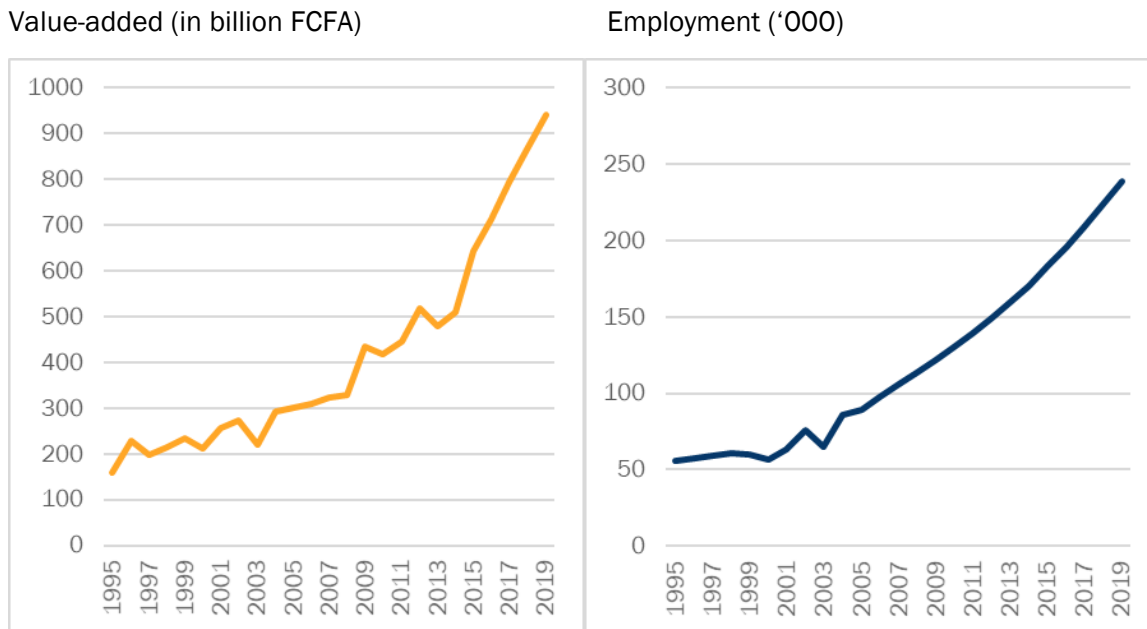
Source: WTTC Data Gateway, 2019.

Figure 6: Evolution of value-added and employment in agro-processing

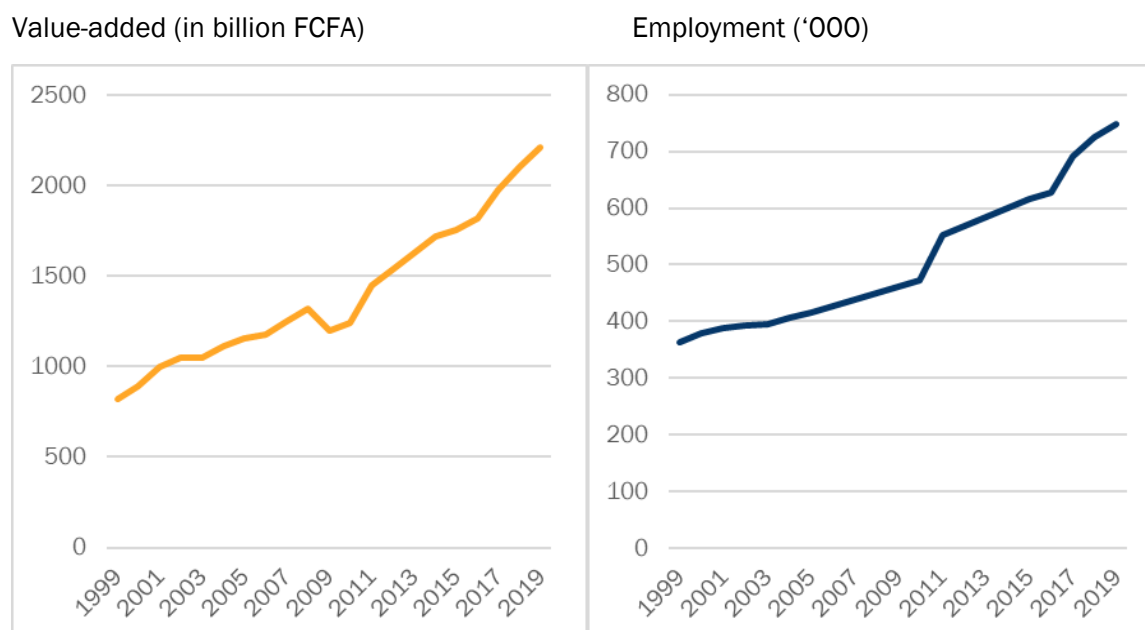


Source: ANSD, 2019 and authors' calculations.

Figure 7: Evolution of value-added and employment in horticulture



Source: ANSD, 2019 and authors' calculations.

Figure 8: Evolution of value-added and employment in manufacturing

Source: ANSD, 2019 and authors' calculations.

These general trends are confirmed by comparing employment elasticities between IWOSS and other sectors (Table 4). Employment elasticity for tourism and agro-processing is at around 0.96 and 0.88, respectively—both higher than manufacturing (0.54). Horticulture's is even higher, at 0.97. Notably, employment elasticities are, in general, much higher for women than for men.

Table 4: Employment-output elasticity for Senegal

	Total	Male	Female
Overall economy	0.55	0.43	0.76
Total IWOSS	0.77	0.65	0.97
Agro-processing	0.88	0.73	1.15
Horticulture	0.97	0.9	1.16
Tourism	0.96	0.81	1.14
ICT	0.19	0.13	0.29
Transport	0.24	0.14	0.41
Financial and business services	0.99	0.9	1.13
Trade: formal	1.17	1.04	1.41
Other IWOSS services	0.46	0.35	0.65
Manufacturing	0.54	0.42	0.78
Other non-IWOSS	0.48	0.35	0.70
Agriculture	0.3	0.16	0.5
Mining	0.10	0.06	0.13
Utilities	0.19	0.14	0.31
Construction	0.56	0.44	0.68
Trade: informal	1.14	1.0	1.37
Government	0.4	0.29	0.6
Other non-IWOSS services	0.52	0.43	0.70

Source: ANSD (2019), Direction de l'horticulture, ILOSTAT (2020), authors' calculations.

Overall, while IWOSS experienced an annual growth rate of employment of 4.5 percent between 2001 and 2017, non-IWOSS grew at only 2.7 percent over the same period. Manufacturing's growth rate

was even lower, at 3.4 percent (Table 5). Notably, the comparison of jobs created in IWOSS versus non-IWOSS reveals that change in employment in the former tends to impact women, who are traditionally at a disadvantage in the Senegalese labor market, more favorably. Indeed, while, for men, employment in IWOSS grew by 3.9 percent per annum against 2.4 percent for non-IWOSS over the 2001-2017 period, women experienced an even higher employment growth rate in IWOSS (5.1 percent) over the same period. Notably, though, the employment growth rate for youth (aged 15-24) remains much more limited than for older people. Both for IWOSS and for non-IWOSS, the youth employment growth rate is lower (2.3 percent for IWOSS and 0.0 percent for non-IWOSS) than that of adults (25+ age bracket), whose employment growth rates are 6.2 percent for IWOSS and 4.6 for non-IWOSS.

Table 5: Demographics of IWOSS and non-IWOSS workers, 2001-2017

	Absolute change 2001-2017			Employment share 2001			Employment share 2017			Ave annual growth			
	('000)			(%)			(%)			(%)			
	IWOSS	Non-IWOSS	Manuf	IWOSS	Non-IWOSS	Manuf	IWOSS	Non-IWOSS	Manuf	IWOSS	Non-IWOSS	Manuf	Total
Total	623	1,335	134	100	100	100	100	100	100	4.5	2.7	3.4	3.1
By gender													
Male	264	739	100	51.5	62.4	83.8	52.0	60.0	80.0	3.9	2.4	3.1	2.7
Female	359	596	34	48.5	37.6	16.2	48.0	40.0	20.0	5.1	3.1	4.8	3.6
By age													
15-24 years	74	47	26	27.8	26.8	38.3	19.8	18.8	30.3	2.3	0.4	1.9	0.8
25-34 years	90	5	19	26.1	25.5	21.1	20.2	16.9	18.3	2.8	0.0	2.5	0.7
35-65 years	459	1,282	90	46.2	47.6	40.7	60.1	64.3	51.5	6.2	4.6	4.9	4.9

Source: ANSD, direction de la comptabilité nationale, 2019, ENES, ESAM2, ILOSTAT and authors' calculations.

When we consider the skills level of employees (Table 6), 13.8 percent of IWOSS employees are highly skilled, and 33 percent are skilled, compared to 4.9 percent and 33 percent, respectively, for manufacturing, and 13.1 percent and 22.4 percent, respectively, for other non-IWOSS sectors. For agriculture, by contrast, 80.3 percent of employees are low-skilled workers.

Table 6: Breakdown of sectoral employment by skill level, 2017

	High skilled	Skilled	Low skilled	High skilled	Skilled	Low skilled
	Absolute ('000)			Share (%)		
Total employment	694	1,386	3,363	12.8	25.5	61.8
Total IWOSS	171	407	657	13.8	33.0	53.2
Agro-processing	15	110	242	4.0	30.0	66.0
Horticulture	6	42	160	3.0	20.2	76.8
Tourism	56	182	208	12.6	40.8	46.6
ICT	23	7	2	70.0	22.5	7.5
Transport	2	24	9	4.3	70.1	25.5
Financial and business services	10	1	1	82.0	12.0	6.0
Trade: formal	18	10	12	44.5	24.4	31.1
Other IWOSS services	41	29	21	45.0	31.9	23.1
Manufacturing	16	108	200	4.9	33.3	61.8
Other non-IWOSS	507	871	2,507	13.1	22.4	64.5
Agriculture	55	375	1,751	2.5	17.2	80.3
Mining	15	27	19	25.0	44.4	30.6
Utilities	17	16	6	43.1	41.2	15.7
Construction	12	36	87	8.8	26.6	64.6

Trade: informal	62	235	404	8.9	33.5	57.6
Government	51	5	4	84.8	8.2	7.0
Other non-IWOSS services	295	177	236	41.7	25.0	33.3

Source: ANSD (2019), Direction de l'horticulture, ilostat (2020), authors' calculations.

Thus, there is strong evidence that IWOSS can stimulate African economies and provide sustainable employment opportunities for its growing working-age population. However, there are prerequisites for IWOSS to deliver the expected results. In Senegal, several constraints relative to the country's political economy, infrastructure, and existing human capital can hinder IWOSS's development.

4. Constraints to IWOSS growth

In Senegal, our results show that a vibrant IWOSS sector can stimulate the economy and provide sustainable employment opportunities for its growing working-age population. For such growth and job creation to be possible, though, Senegal must address the many constraints affecting the business environment, especially those in the regulatory framework, infrastructure, and skills development.

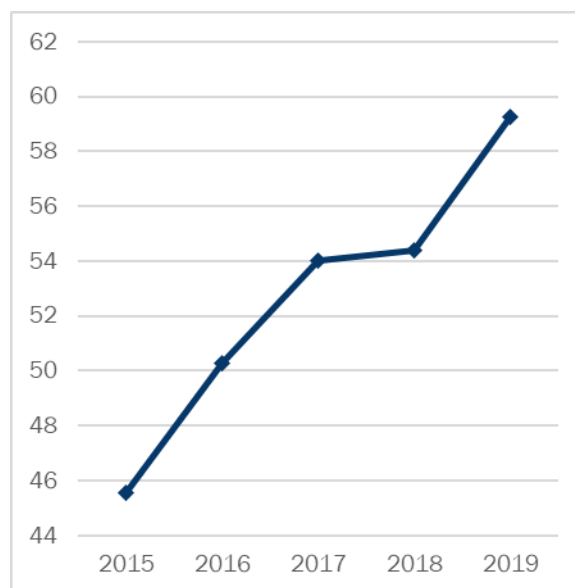
The regulatory environment

Despite some recent improvements, the Senegalese regulatory framework still poses big challenges for private enterprises, especially exporting firms. Senegal's rank did improve from 141th to 123rd between 2019 and 2020 in the World Bank's Ease of Doing Business index (World Bank, 2019a), reflecting the country's efforts and progress towards becoming more investment-friendly. Indeed, Senegal's overall score had been steadily improving in recent years (Figure 9).

More specifically, Senegal has shown significant improvement on indicators like "number of days it takes to administratively start a business," which had shrunk from 91 days in 2015 to 8 days in 2020 (World Bank, 2019a). Then again, despite this tremendous progress, the amount of time to establish a business in Senegal is relatively long and tedious compared to countries with similar levels of economic development. Indeed, the process serves as a barrier, as it is not a "one-stop-shop" and is extremely confusing to investors unfamiliar with the Senegalese administrative system (Millennium Challenge Corporation (MCC), 2017). Principal restrictions include difficulty in accessing credit, lengthy administrative processes, and a lack of mechanisms for contract enforcement and ownership rights (MCC, 2017).

There are several barriers relative to hiring and firing workers. For instance, it costs as much as the equivalent of 38 weeks of wages to part ways with a worker in Senegal (Golub et al., 2015). In terms of overall stability and consistency of labor market legislation, Senegal ranks 187 out of 189 countries (Golub and Mbaye, 2019b). Indeed, a recent analysis of African export processing zones points to stringent labor market regulations and employment requirements forced on companies to secure space in the Dakar Free Zone (DFZ) as a major cause of the failure of the DFZ (Golub and Mbaye, 2019b).

Figure 9: Senegal: Ease of doing business score

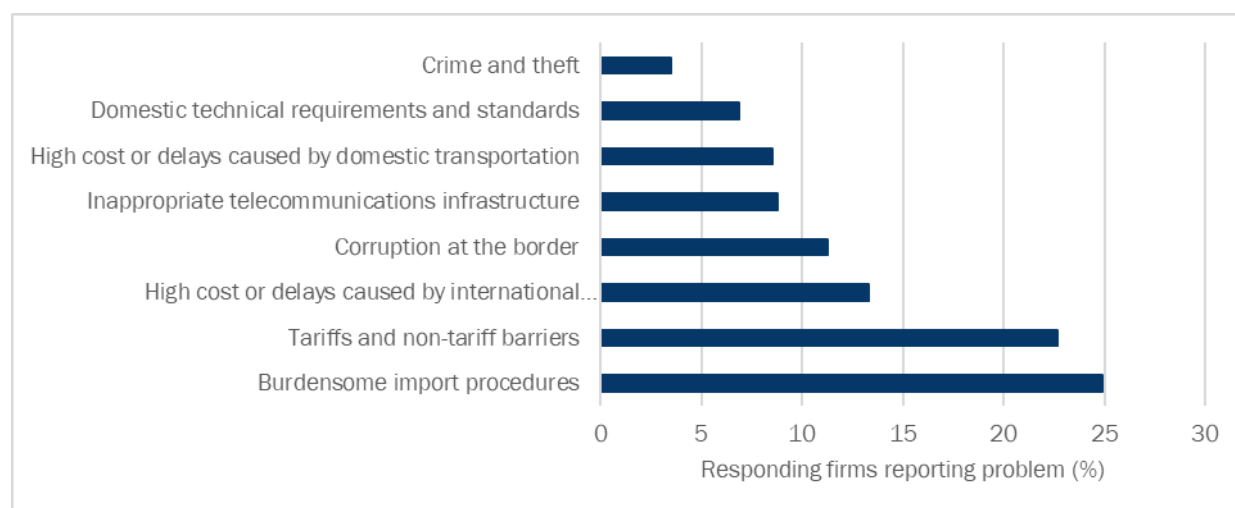


Note: 0 = lowest performance to 100 = best performance
Source: World Bank, 2019a.

Despite substantial trade liberalization policies in Senegal's since 2000, barriers to importing and exporting persist as another manifestation of Senegal's weak regulatory system. Indeed, Senegal-based companies are around 33 percent less likely to use foreign materials as production inputs (MCC, 2017). Exporting a regular container of products requires up to six documents and up to \$1,225 in fees. Importing the same container requires five documents and a \$1,740 fee.

Indeed, access to imported inputs at reasonable cost seems to be a significant obstacle for exports (WEF Global Enabling Trade Report, 2016). Also, though 66 percent of companies reported facing non-tariff barriers to trade, 83 percent of the barriers faced by importers are linked to exceptional or informal payments (MCC, 2017).

Figure 10: Most problematic factors for importing in Senegal



Source: GETR, 2016. <https://reports.weforum.org/global-enabling-trade-report-2016/>

Contract compliance is another area of weakness in Senegal's business climate, as the country Senegal ranking 145 out of 189 countries on contract compliance. Furthermore, around 27 percent of businesses characterize contract enforcement as a major constraint to their business (World Bank, 2015) primarily due to corruption and low judicial capacity.² Tax administration is also burdensome for Senegalese businesses: The country is ranked 166 out of 190 in terms of tax payments (World Bank, 2019a): On average, it takes up to 620 labor hours per year for businesses to register and pay their taxes. Finally, the number of different taxes that a company has to pay can be as high as 58 (MCC, 2017).

Infrastructure

Infrastructure plays an important role in shaping a country's business environment. In Africa, in general, and Senegal, in particular, infrastructural services are usually found to be of poor quality in addition to having much higher costs. For example, Senegal's rate of electrification is around 45 percent nationwide (75 percent in urban areas and 17 percent in rural areas) (EnDev, 2019), and electricity is more expensive in Senegal than in the average African country (MCC, 2017). MCC (2017) also finds that the low electrification of rural areas is detrimental to business competitiveness: Since most horticultural products (as well as other raw materials for agri-business) come from the country's rural areas, the lower electrification of rural areas reduces firms' cost-effectiveness by increasing both costs

² See: <https://www.kpmg.com/Africa/en/KPMG-in-Africa/Documents/Senegal.pdf>; http://pdf.usaid.gov/pdf_docs/PNADK548.pdf; <http://www.business-anti-corruption.com/country-profiles/senegal>

and uncertainty around production. More specifically, 8 percent of the companies interviewed in the World Bank Enterprise Survey 2014 name electricity as the main constraint to conducting their business activities whereas 48.2 percent characterize it as a significant constraint to doing business.

Up to 85 percent of Senegal's electricity supply comes from thermal sources, mainly from the heavily subsidized national utility company, SENELEC, which has a monopoly status. Outages—both planned and unplanned—affect all regions of the country. Such transmission losses, along with dependence on older plants, all add to the high electricity costs (MCC, 2017). Just connecting to the grid is tough: Electric installations can take firms 75 days and cost as much as 3.42 percent of income per capita (World Bank, 2019a). A kw/h of electricity in Senegal costs around \$0.30, while in emerging markets it ranges from \$0.04 to \$0.08, and \$0.13 in sub-Saharan Africa (MCC, 2017).

Ground transportation is also a major constraint to the business environment in Senegal. MCC (2017) estimates that up to 25 percent of paved roads and 53 percent of unpaved roads are in poor condition, and many areas are still enclaved. Cartelization and corruption at checkpoints are further contributing to the high costs of transportation (MCC, 2017). When it comes to the quality of relevant infrastructure, the WEF Travel and Tourism Competitiveness Guide in 2019 ranked Senegal 94 out of 140 countries. Less than 15 percent of people live near a stretch of at least 5 km of roads. Senegal's telecommunications sector has been liberalized since 1996, and since then controlled by a consortium, led by *France Télécom*, which holds a monopoly status.

Exports

Senegal has the advantage of having a stable national currency and a democratic political system. The country has also made some progress in offering a fairly attractive export system, including no export taxes, fast capital and income repatriation, and a decent telecommunications network (MCC, 2017). Senegal has also signed several trade agreements providing it with preferential market access, including bilateral deals with many major economies (in particular China and the United States), and is also a signatory to the Cotonou Agreement granting (reciprocal) duty-free access to the African, Caribbean, and Pacific export markets as well as the European Union (EU).

Despite these opportunities, Senegal's exports are still highly concentrated in a limited basket of goods, such as: gold (15.5 percent), petroleum oils (14.8 percent), diphosphorus pentoxide (7.8 percent), frozen fish (6.8 percent), and cement (4.3 percent) (Comtrade, 2018). Estimates show that 70 percent of non-tariff barriers are imposed by foreign regulations, and 30 percent by the Senegalese government itself (ITC, 2013). The vast majority of those non-tariff barriers relate to import quotas, required special licenses, restrictions on exports, subsidies on exports, phytosanitary and sanitary standards, and rules-of-origin laws (ITC, 2013). Most of the foreign direct investment (FDI) Senegal has received recently has come from emerging nations (China, Brazil, India, and the Middle East), where such standards are much lower. Despite recent reforms in improving the overall functioning of its port, the World Bank still ranks Senegal 141st out of 160 countries, behind other West African countries such as Benin, Côte d'Ivoire, Ghana, and Nigeria in its Logistics Performance Index (World Bank, 2018b).

Agglomeration

Since the mid-1970s, Senegal has begun developing export processing zones (EPZ), starting in Dakar. The Dakar EPZ provided exemptions from corporate income taxes, customs duties, and equipment taxes, along with unrestricted repatriation of capital and profits. Despite these policies, in 1986, jobs at the Dakar EPZ reached a peak of only 1,200 before declining to 600 in 1990. The project was eventually abandoned in 1999 when it was only housing 14 participating companies with a total of 940 workers. Its inability to ignite job growth reflected significant shortcomings in the overall business climate, in particular labor market rigidities, high energy and transportation costs, and inefficient bureaucratic procedures. The EPZ has struggled to insulate businesses from these problems deeply

rooted in the Senegalese economy. For example, since its independence, Senegal has suffered from a prolonged period of currency overvaluation, finally ending with a major devaluation of 50 percent in 1994. In addition, Senegal's weak infrastructure, its failure to provide opportunities in a timely manner, and its failure to separate companies from onerous labor market legislation and union agitation, all played a role in undermining the zone (Golub et al., 2019; Farole, 2010).

Firm capabilities

Firm capabilities refer to a broad variety of business characteristics such as: expertise, work experience, efficiency, management quality, and the ability to produce new products (Page 2019). Surveys conducted in Senegal found that most businesses feel they lack the technological and managerial skills to succeed on the international market (Golub et al., 2019). Some of them, for example, are intimidated by the size and price demands of European and U.S. markets. Although they want to sell, they don't trust they will meet the price and timeliness requirements imposed by demanding international buyers. While one part of the issue is lack of adequate information, more significantly, they do not believe they have the necessary technical mastery of production (Golub et al., 2019).

One realistic solution might be for African firms to enter into sub-contracting agreements with international companies that may help with the transition to more complex and large-scale production. Indeed, according to Golub et al., (2019), some of these local firms welcomed the idea of partnerships with foreign firms, particularly if they involve technology transfer but have no idea how to attract foreign buyers to Senegal or how to enter into these partnerships.

5. A value-chain analysis of industries without smokestacks in Senegal

In this section, we undertake a value chain analysis of IWOSS sectors in Senegal, focusing on horticulture, agri-business, and tourism.

Horticulture

The horticultural industry in Senegal has demonstrated strong dynamism in the last 10 years. National production increased from 860,000 tons in 2011 to 1,320,399 tons in 2017, and exports grew eightfold between 2004 and 2017. The industry's market structure remains fairly concentrated with about 20 major exporters, seven of whom account for 75 percent of the total exports whereas the rising domestic demand is supplied by the small producers (Golub et al., 2019). Production being mainly concentrated in the Niayes coastal strip and in the Senegal River Valley, Senegal has favorable soil-climatic conditions for horticulture in several areas of the country. The Niayes area occupies the Atlantic fringe of the Senegalese coast north of Dakar and stretches across a length of 180 km of coastline, with widths ranging from 5 to 30 km, with an area of approximately 3,090 km² covering 4 administrative regions with an estimated 700,000 inhabitants: Dakar, Thiès, Louga, and Saint-Louis. The Niayes area has a sub-Canary style climate with relatively low temperatures for a big part of the year, favorable to the production of products in high demand in European markets. Other important production areas in Senegal are Saint-Louis and Dagana departments in the Saint-Louis region in northern Senegal.

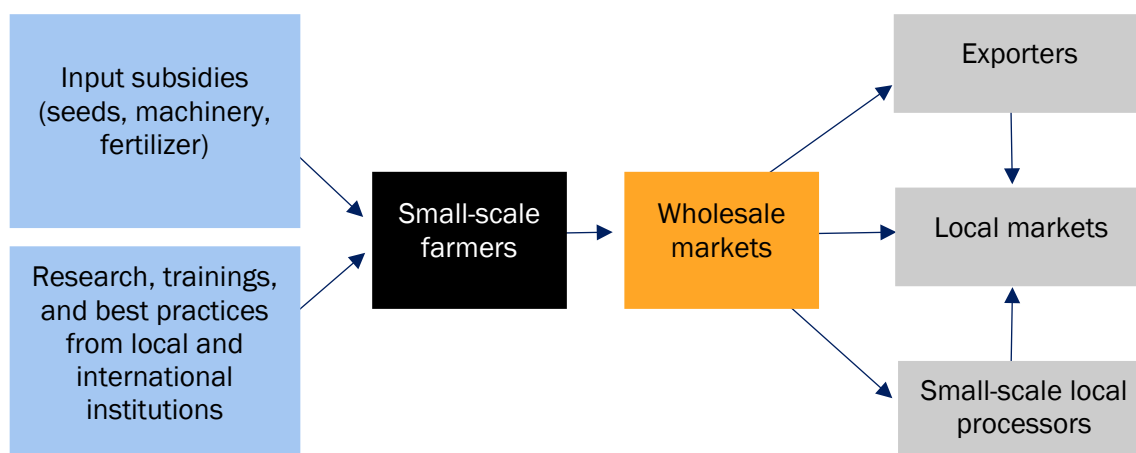
In 2003, the first foreign horticultural export firm invested in the Senegalese horticultural sector. Since then, the number of major exporters has risen to six, and, simultaneously, the areas being cultivated as well as the variety of products produced continues to grow. All the export companies depend entirely on a vertically integrated production system structured within the organization with primary processing, post-harvest handling, and exporting units. Around 6,000 jobs have been generated by FDI injection

in the region, 80 percent of which are held by women. These jobs concern harvesting, manufacturing, and packaging operations, and job holders are employed on a permanent, seasonal, or regular basis.

Pest attacks, packaging problems, and a lack of training for producers on new innovative practices and technologies are factors leading to significant post-harvest losses, and thus, constraining the growth of the sector. Moreover, the increasing necessity of quality certification and the difficulties of satisfying its demanding quality norms have restricted growth of the sector in the early 2000s (Golub et al., 2019b; Mbaye and Gueye, 2015). A number of other substantial, though not insurmountable, constraints impede expansion of the sector, including relatively high costs of inputs due primarily to scarcities of skilled labor, arable land, water, and credit. These costs are exacerbated by lack of basic infrastructure, namely good roads. Furthermore, due to the high temperatures in certain areas of the country coupled with the low electrification of those areas, yield losses sometimes reach 40 percent for certain crops such as tomatoes. Furthermore, overproduction during rainy seasons combined with the lack of proper conservation infrastructures leads to loss of income.

The value chain of the horticulture sub-sector, as shown in Figure 11, is quite straightforward in Senegal, with a limited number of involved actors. First, farmers, mainly small-scale producers, benefit from input (seeds and fertilizers) subsidies from the government as well as many technical inputs from both local and international institutions as a means to bolster their production. After harvest, Senegalese the government create incentives for the local production of horticultural products through protectionist measures by restricting imports and suspending them during periods of peak harvest. Indeed, Senegalese producers have three options: 1) sell to Senegal to middle-men in local markets, 2) sell to local small-scale processing firms, and 3) export to foreign markets.

Figure 11: Value chain of the horticulture sub-sector in Senegal



Source: Authors' calculations.

Tourism

In Senegal, the integration of tourism with other sectors like agriculture, fishing, handicrafts, culture, construction, and transport makes it one of the central sectors of the national economy. La Somone and Saly, the two historic hubs sponsored by tour operators, are now "ageing." Recently, new areas are under construction including Pointe Sarène and Nianing. Such projects are also conducted in the context of culture and history promotion around Dakar and the island of Gorée (slavery commemoration), art events (Dakar Biennale of Contemporary African Art, etc.), historical vestiges and festivals in Saint Louis, and finally in Touba (the capital of Mourides that draws 2.5 million people each year on average as part of an annual pilgrimage). Nature and ecotourism, mainly around Sine Saloum and Casamance, are also growing but are currently underexploited due to financial, security, and

accessibility issues (e.g., there is only one foreign brand, Club Med, in the region). Other areas of interest such as the desert of Lampoul are potential candidates for site diversification.

Despite these myriad opportunities, the sector currently struggles to live up to its potential. For example, English (2018), underscores the dramatic decline of the tourism sector in Senegal, with the country's Travel and Tourism Competitiveness ranking by the World Economic Forum dwindling from second in Africa, just behind Kenya in the 1980s, to lower than tenth. Likewise, the number of issued visas has fallen in the recent years: For example, Sperandio (2015) mentions that the Senegalese consul in Paris issued only 19,738 visas in 2014 and only 3,577 between January and April of 2015. He posits that the drops in tourism revenues might be explained by its decrease as a popular destination that it “does not sell itself like it used to.”

Moreover, a policy mandating visas—under the pretense that it is hard for Senegalese citizens to get visas to Europe and America, therefore, it is only fair to ask tourists to present visas upon entering Senegal—may have backfired (English, 2018). Policymakers hoped to generate revenue through visa processing fees, but, as soon as the biometric visa and associated fees were put in place, tourist visits to Senegal dropped by 30 to 40 percent (Sperandio, 2015). Additionally, unrest in the south of the country as well as neighboring countries also deter tourists from visiting Senegal (Sperandio, 2015).

A future threat to Senegal's promising tourism sector, though, is climate change and related rising sea levels. Because most of Senegal's tourist attractions are related to some extent to oceanic life, climate change's threat to the country's beaches is already adversely impacting sector.

Information and communications technologies

Since the 1997 privatization of Senegal's telecommunication monopoly, SONATEL, with France Telecom as the strategic partner, assessments of the country's level of relevant infrastructure and service quality are rather favorable. The sector was further liberalized in subsequent years; now, the country has three companies providing telephone and internet services. Moreover, significant expansion of mobile phone and internet access has led to more than 94 percent of the population having access to a mobile phone and internet. IT-based services are also expanding, and increasingly spanning all sectors of activities. Despite a significant level of investment, including a submarine fiberoptic cable, costs of telecommunications and internet are still rather high in Senegal (English 2018). Moreover, SONATEL still holds a very strong grip on the whole industry, which prevents prices from lowering, and small start-up companies from emerging. Thoughtful reforms in the sector would dramatically contribute to unlocking the huge potential of the sector to thrive and jumpstart backward and forward linkages within the economy.

Agro-processing

Senegal is an example of the paradox in which a country has significant agricultural resources but still relies on food imports to feed its population. The irrigable potential of the country is enormous, around 397,100 hectares, but only 106,600 of the areas are managed, including 76,000 hectares in the Senegal river valley. In addition, while agriculture employs nearly 50 percent of the working-age population, it receives around 11.3 percent of public investment (DGPPE, 2018) and contributes only 9.4 percent to the national GDP (ANSD, 2020).

Main agri-business value chains include rice, sugar and beverage, flour, and fish and seafood, among other items. The cotton value chain is organized around the national company for textile fibers (SODEFITEX),³ which is in charge of cotton ginning. Notably, cotton is characterized by erratic

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production and exports patterns, as it is subject to the vagaries of rainfall and volatility of international prices.

Rice production in Senegal has been steadily rising in recent years. Rice cultivation and processing mainly occur around the delta of the Senegal and Casamance Rivers. Local marketed rice is often produced from irrigated rice farms, whereas rainfed rice is mainly intended for self-consumption. Processing is carried out by the producers themselves or by the service providers. Yields are rather high compared to international levels, and rice growth models predict a potential yield of irrigated rice in the Sahel of 9 to 12 tons/hectare. Other agro-processing value chains include beverage, fish and seafood, food preparation, and salt—all of which have huge exporting potentials that are yet to be realized (Golub et al., 2018).

Sugar in Senegal also has huge exporting potential, but political economy-related factors have become an obstacle (Mbaye, Golub, and English 2016), with the government facing pressure from competing interest groups. Sugar is an important part of the local consumption basket of households as well as a rural-based industry. Since 1972, sugar production in Senegal has been controlled by the *Compagnie Sucrière Sénégalaise* (CSS) on an area of 9,600 hectares near Richard Toll in the Senegal River valley. Annual production reached about one million tons of sugar cane in 2013, or 100,000 tons of refined sugar. The CSS employs around 6,000 workers, with an approximate payroll of CFAF 16 billion (around \$32 million) in 2013, making it the second-largest employer in Senegal after the government. Many of these workers are part-time and hired for harvesting. Importantly, CSS is also a major importer of sugar. A few large traders, represented by the UNACOIS association,⁴ are also involved in sugar importing, putting them in open conflict with CSS.

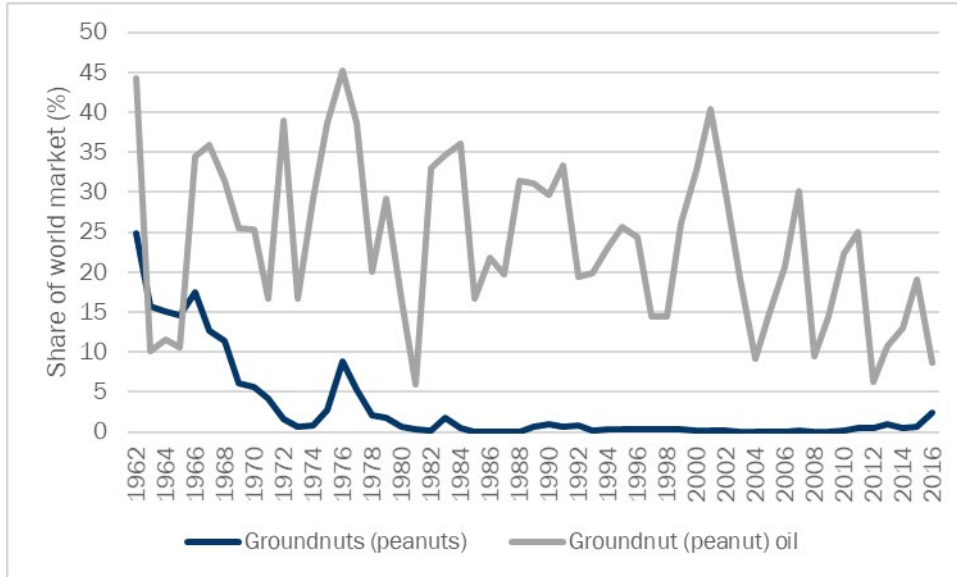
Senegal has historically been one of the world's top producers of groundnut oil and oilcake (Mbaye 2005), which made up 20-30 percent of the country's exports between 1960 and 1980. Starting from 1990s, unstable market prices, unpredictable weather, and lousy fiscal policies, all contributed to destabilize the sector exposing the need to diversify away from peanut oil (Golub and Mbaye, 2002; Mbaye, 2005). Figure 12 shows Senegal's share of the world market in groundnuts and groundnut oil, further highlighting the country's highly variable share of the world market, with a clearly downward trend over time. For example, exports of unprocessed groundnuts have dropped to almost nothing after 1970 from a large global share in the 1960s. Until 2005 the government retained a near monopoly on the production of vegetable oils through the parastatal SONACOS, which was privatized in 2015 and renamed SUNEOR. Several other firms compete with SUNEOR in some product lines but SUNEOR retains a dominant market share. On the other hand, SUNEOR also faces competition from imported palm oil from Côte d'Ivoire, a member of WAEMU, and Southeast Asia. Thus, the main impediments to the sector's competitiveness are the failure to implement bold successful reforms in the groundnut production value chain and permanent fighting among manufacturers and importers/traders.

As the former capital of French West Africa, Senegal experiences unusually strong French influence in its private entrepreneurship. One manifestation of this influence is that French-style baguettes have become a staple consumption item, even though wheat cannot be produced in Senegal. Since flour imports have declined to very small levels since the early 2000s, Senegal imports and processes nearly all the wheat used for its estimated daily consumption of 3 million baguettes. There are four flour producers, with the largest being the *GrandsMoulins de Dakar*, controlled by the same family that owns the sugar monopoly CSS, with about 65 percent market share of the flour market. Thus, like sugar and vegetable oil, flour production is characterized by a dominant figure but, unlike them, is subject to somewhat more competition. Millers manage their own imports of wheat, from which they produce flour as well as animal feed, with higher profit margins on the latter. Flour is sold to bakeries

⁴ Union Nationale des Industriels et commerçants du Sénégal, an association of the most important informal sector actors, operating primarily in commerce and other services such as transportation.

on credit. Bread is supplied by a competitive market with about 1,000 bakeries around the country. Controlling the price of bread is highly problematic in a situation where flour prices are free to move. For this reason, in late 2012, the new Senegalese government moved to fix the price of flour along with the price of bread. Until now, a very fierce battle involving the different actors of the value chain (millers, wheat and flour importers/traders, as well as bakeries) considerably interferes with policies in the sector.

Figure 12: Senegal’s share of world exports of groundnuts and groundnut oil (%)



Source: Golub et al., 2015.

Senegal is seen as one of the richest fishing grounds in the world, and fish is the main source of protein for the Senegalese population (Golub and Mbaye 2002, 2018; Mbaye 2002). Though its share has been declining since the 1990s, fishing still accounts for around 15 percent of Senegal’s exports. The fishing industry is also highly labor-intensive, with direct and indirect employment estimated at about 10 percent of Senegal’s working population. Moreover, a large array of activities—including fish processing and distribution—primarily employs women. Over the last 20 years, the fishing industry has encountered many challenges, including overfishing, foreign competition, climate change, and dysfunctional local institutions. All these have resulted in a dramatic drop in fish stocks.

The industry is highly dualistic, with the coexistence of formal industrial and informal “artisanal” fishing, with the latter generating the bulk of employment existing in the industry. These two types of fishing compete to varying degrees for many of these species, with artisanal fishing dominating coastal surface fishing, which consists mainly of smaller fish such as sardines, mostly destined for local consumption or other African countries. On the other hand, industrial fishing dominates the highly lucrative coastal bottom species such as grouper, yellowfin, mullet, and sole, which are exported, primarily to Europe. Most of the fresh fish exports are caught by artisanal fisherman, and delivered to industrial processing factories located around Dakar. Frozen fish exports mostly originate from the industrial fishing fleet equipped with freezing facilities. Tuna catches are mostly intended for canning. The major impediments limiting the industries growth include overfishing, inadequate infrastructure (electricity availability), and poor unloading and processing facilities for artisanal fishing.

6. Future trends: Potential growth and labor demand

In this section, we look 18 years ahead to estimate the growth of the national economy and how that economic growth will shape IWOSS in terms of value-added growth, employment, and skills. We assume that value-added growth for non-IWOSS between 2017-2035 will be the same as that between 2007-2017. For IWOSS, we assume the annual growth rate between 2017-2035 will be double that of 2007-2017. In doing so, we assume that some of the most important hurdles impeding IWOSS growth will be removed with relevant policies and investments as pledged by the government in many recent policy orientation documents. Figure 13 depicts the projected evolution of employment for IWOSS, non-IWOSS, and manufacturing sectors. Unsurprisingly, it shows aggregate IWOSS jobs gradually picking up from non-IWOSS over time, consistent with previous observations and assumptions.

Figure 13: Projection of the number of jobs (2017-2035)



Source: ANSD-Direction de la comptabilité Nationale, 2019 ; ENES, authors' calculations.

Table 7 shows that, over the 2017-2035 period, IWOSS jobs will increase more than tenfold to occupy 52.8 percent of the employment share. On the other hand, non-IWOSS jobs will increase by more than 329 percent and will occupy 44 percent of the employment share. Among IWOSS sectors, horticulture has the highest growth rate at 19 percent per annum over the sample period. The annual growth rate for agro-processing is 10.1 percent, 7.6 percent for tourism, 12.1 percent for ICT, 13.6 for transport, and 15.5 for finance.

Table 7: Projected GDP and labor demand

	GDP			Employment				Share of total employment	
	2017	2035 (Proj)	Annual growth	2017	2035 (Proj)	Add. jobs	Annual growth	2017	2035 (Proj)
	(local currency in bn)	(local currency in bn)	%	('000)	('000)	('000)	%	%	%
Overall economy	11,860	77,664	11.0	5,444	16,429	10,985	6.3	100	100
Total IWOSS	5,847	58,685	13.7	1,234	8,670	7,435	11.4	22.7	52.8
Agro-processing	934	5,243	10.1	367	1,690	1,323	8.8	6.7	10.3
Horticulture	795	18,205	19.0	209	4,391	4,182	18.4	3.8	26.7
Tourism	996	3,699	7.6	446	1,575	1,129	7.3	8.2	9.6
ICT	550	4,310	12.1	33	50	17	2.3	0.6	0.3
Transport	265	2,621	13.6	35	62	27	3.3	0.6	0.4
Financial and business services	276	3,710	15.5	12	221	209	17.7	0.2	1.3
Trade: formal	389	2,780	11.5	40	392	352	13.5	0.7	2.4
Others IWOSS services	1,641	18,117	14.3	92	289	197	6.6	1.7	1.8
Manufacturing	993	2,444	5.1	324	534	211	2.8	5.9	3.3
Other non-IWOSS	5,020	16,535	6.8	3,886	7,225	3,339	3.5	71.4	44.0
Agriculture	1,032	4,183	8.1	2,182	3,359	1,177	2.4	40.1	20.4
Mining	318	1,378	8.5	62	72	10	0.8	1.1	0.4
Utilities	258	2,026	12.1	38	58	19	2.3	0.7	0.4
Construction	335	1,157	7.1	134	272	138	4.0	2.5	1.7
Trade: Informal	1,188	3,647	6.4	701	2,504	1,803	7.3	12.9	15.2
Government	636	2,336	7.5	61	103	43	3.0	1.1	0.6
Other non-IWOSS services	1,253	1,808	2.1	708	857	149	1.1	13.0	5.2

Source: ANSD-Direction de la comptabilité Nationale, 2019 ; Direction de l'horticulture, authors' calculations.

A breakdown of jobs by skills (Table 8) shows that, while the share of skilled and high-skilled workers will increase in the overall economy, for IWOSS, the increase will be 1.4 percentage points for highly skilled, and 6.4 percentage points for skilled workers by 2035. In terms of annual growth rate, the number of skilled jobs will increase by 11.6 percent for IWOSS, against 4.1 percent for non-IWOSS and 7 percent for the overall economy.

Tables 9 and 10 estimate skills gaps for IWOSS and non-IWOSS by level of education. The tables show that the magnitudes of skills gaps are much larger for non-IWOSS than for IWOSS when it comes to secondary education or less, and similar magnitudes for post-secondary and university-level education.

Table 8: Projected labor demand by skill level

	2017			2035 (Projected)						Annualized growth		
	High skilled	Skilled %	Low skilled	High skilled	Skilled Absolute ('000)	Low skilled	High skilled	Skilled %	Low skilled	High skilled	Skilled	Low skilled %
Total employment	12.8	25.5	61.7	2,337	5,238	8,852	14.2	31.9	53.9	7.0	7.7	5.5
Total IWOSS	13.8	33.0	53.2	1,242	2,980	4,448	14.3	34.4	51.3	11.6	11.7	11.2
Agro-processing	4.0	30.0	66.0	169	650	871	10.0	38.5	51.5	14.5	10.4	7.4
Horticulture	3.0	20.2	76.8	267	1,247	2,877	6.1	28.4	65.5	23.1	20.7	17.4
Tourism	12.6	40.8	46.6	247	771	557	15.7	48.9	35.4	8.6	8.3	5.6
ICT	70.0	22.5	7.5	36	11	2	73.1	22.0	5.0	2.5	2.2	0.0
Transport	4.3	70.1	25.5	5	46	11	7.4	74.3	18.3	6.4	3.6	1.4
Financial and business services	82.0	12.0	6.0	186	26	9	84.0	12.0	4.0	17.8	17.7	15.1
Trade: formal	44.5	24.4	31.1	186	128	78	47.5	32.6	19.9	13.9	15.3	10.7
Other IWOSS services	45.0	31.9	23.1	145	101	43	50.2	34.9	14.9	7.2	7.1	4.0
Manufacturing	4.9	33.3	61.8	56	195	283	10.5	36.5	53.0	7.2	3.3	2.0
Other non-IWOSS	13.1	22.4	64.5	1,040	2,064	4,120	14.4	28.6	57.0	4.1	4.9	2.8
Agriculture	2.5	17.2	80.3	187	717	2,453	5.6	21.4	73.0	7.1	3.7	1.9
Mining	25.0	44.4	30.6	20	35	17	28.1	48.6	23.3	1.5	1.4	-0.7
Utilities	43.1	41.2	15.7	27	26	5	46.2	45.3	8.5	2.7	2.9	-1.2
Construction	8.8	26.6	64.6	32	84	156	11.8	30.8	57.4	5.7	4.8	3.3
Trade: Informal	8.9	33.5	57.6	300	942	1,262	12.0	37.6	50.4	9.1	8.0	6.5
Government	84.8	8.2	7.0	90	9	5	86.8	8.2	5.0	3.1	3.0	1.1
Other non-IWOSS services	41.7	25.0	33.3	384	250	223	44.8	29.2	26.0	1.5	1.9	-0.3

Source: ANSD, ENES 2015, ILOSTAT 2020.

Table 9: Sectoral skills gap in IWOSS

2035	Less than secondary	Secondary	Post-secondary certificate	University
	Absolute ('000)			
Total labor supply	10,937	5,504	1,265	1,073
IWOSS labor demand	816	3,963	1,633	1,023
Sectoral skills gap	10,121	1,541	-368	49
Skill availability ratio	13.41	1.39	0.77	1.05

Source: ANSD, Direction de l'horticulture, O'NET

Table 10: Sectoral skills gap in non-IWOSS

2035	Less than secondary	Secondary	Post-secondary certificate	University
	Absolute ('000)			
Total labor supply	10,937	5,504	1,265	1,073
IWOSS labor demand	432	1,338	1,085	484
Sectoral skills gap	10,504	4,167	180	588
Skill availability ratio	25.31	4.11	1.17	2.22

Source: ANSD, Direction de l'horticulture, O'NET

Tables 11 through 13 show occupational skills gaps for some IWOSS sectors (horticulture, tourism, and agro-processing). They serious gaps in critical occupations for these sectors, meaning that should IWOSS be expanded to become the leading sector of the economy in the coming years, significant effort will need to be accounted for to mitigate the skills gap constraint.

Table 11: The occupational skills gap for selected occupations in horticulture

	Years of schooling		
	Skill supply	Skill requirement	Skills gap
Farmworkers and laborers	6	10	-4
Agricultural equipment operators	6	10	-4
First-line supervisors of agricultural crop and horticultural workers	6	13	-7
Graders and sorters, agricultural products	6	10	-4
Agricultural engineers	6	15	-9
Farm equipment mechanics and service technicians	6	13	-7
Agricultural inspectors	6	13	-7
Food science technicians	6	15	-9

Source : ANSD-Direction de la comptabilité Nationale, 2019, ENES, authors' calculations.

Table 12: The occupational skills gap for selected occupations in tourism

	Years of schooling		
	Skill supply	Skill requirement	Skills gap
Cooks, fast food	6	13	-7
Hosts and hostesses, restaurant, lounge, and coffee shop	6	13	-7
Cooks, restaurant	6	13	-7
Hotel, motel, and resort desk clerks	6	13	-7
Waiters and waitresses	6	13	-7
Dishwashers	6	10	-4
Bartenders	6	13	-7
Lodging managers	6	15	-9
Food preparation workers	6	13	-7
Food service managers	6	13	-7

Source : ANSD-Direction de la comptabilité Nationale, 2019, ENES, authors' calculations.

Table 13: The occupational skills gap for selected occupations in agro-processing

	Years of schooling		
	Skill supply	Skill requirement	Skills gap
Slaughterers and meat packers	6	13	-7
Cabinetmakers and bench carpenters	6	13	-7
Food batchmakers	6	13	-7
Sawing machine setters, operators, and tenders, wood	6	13	-7
Fabric and apparel patternmakers	6	13	-7
Industrial engineers	6	15	-9

Patternmakers, wood	6	13	-7
Model makers, wood	6	13	-7
Fabric makers, except garment	6	13	-7
Food science technicians	6	13	-7

Source: ANSD-Direction de la comptabilité Nationale, 2019, ENES, authors' calculations.

7. Firm survey results

In an effort to better understand youth employment in Senegal's IWOSS sectors, a series of 11 interviews were conducted. The 11 interviews were distributed as follows:

- 6 agro-processing
- 3 horticulture
- 2 tourism

7.1 Current youth employment: the required formal education

In order to better understand youth employment in the IWOSS sectors in Senegal, we conducted interviews with 11 companies, including six in the agro-processing sector, three in horticulture, and two in tourism. During these interviews, discussions revolved around the following points: the identification of opportunities and constraints to the development of value chains, the three main occupations occupied by young people (15-24 years) as well as the diplomas required to exercise these occupations, skills requirements for young occupations identified, the importance of digital skills, and medium-term development plans for companies. Interviewees were asked to rate the skill importance levels on a scale of 1 to 5. The skills include: basic, systems, social, technical, resource management and problem solving. Tables 15-17 summarize the interview results.

Agro-processing

In Senegal, the agro-processing sector helps solve both issues relative to post-harvest losses and the diversification of products.⁵ The emergence of small- and medium-sized enterprises and industries also helped meet the local high demand in local products such as fruit juices, vegetables, and cereals. The sector is marked by a pronounced duality between a modern structured sector and a multiplicity of formal and informal processing units that limit the development of the value chain.⁶

The conducted interviews allowed for the identification of the four positions most likely to be held by young employees (aged 15-24), as summarized in Table 14. Among those positions, electromechanic was the most frequent. That position requires a professional certification, *Brevet de Technicien Supérieur* (BTS), which is a post-secondary degree. Food technician is the next most frequent position for the youth in the interviewed firms. This position also requires a *Brevet de Technicien Supérieur* or a bachelor's degree.

Table 14: Main occupations for youth (15-24 years) in agro-processing firms

Profession	Number	Diploma
Accountant	9	BTS/Bachelor's/Master's degree
Marketer	8	BTS/Bachelor's/Master's degree
Electromechanic	23	BTS
Food technician	20	BTS/Bachelor's/Master's degree

⁵ <https://sunumbay.com/index.php/2019/05/14/agroalimentaire-au-senegal-enjeux-opportunités-et-defis/> consulté ce 29/03/2020

⁶ Direction de l'Appui au Secteur privé (DASP): « L'industrie agroalimentaire du Sénégal, enjeux et défis majeurs », 2012

Of these occupations, interviewees identified food technician as the position requiring the most skills. More specifically, respondees noted that basic, systems, and problem-solving skills are necessary for food technicians. Accountants and electromechanics have relatively similar average requirements, and problem solving skills are the most required for youth occupations in the agro-processing sector.

Table 15: Importance of relevant skills required for main youth occupations identified in the agro-processing sector

	Accountant	Marketer	Electrical mechanic	Food technician
Basic skills	4.0	3.9	4.0	4.0
Social skills	3.2	4.0	3.2	3.9
Problem solving	4.8	4.6	5.0	5.0
Technical skills	3.5	1.9	4.7	3.9
Systems skills	4.0	3.3	3.4	4.0
Resource management skills	4.0	2.8	3.4	3.7
Mean score	3.9	3.4	3.9	4.1

In each of these professions, firm managers deemed computer literacy particularly important as it is needed for sorting and peeling quality seeds, prospecting markets, creating invoices, and managing products and human resources.

In the medium term, the interviewed agro-processing firms indicated that they aim to increase their production capacity, acquisition of additional equipment and the recruitment of qualified personnel. The ECOWAS Common External Tariff (CET), which opens up the West African market is also an opportunity these agro-processing firms intend to seize. To do so, it is primordial to bring factories closer to areas of production in an effort to lower production costs and thus increase competitiveness. In the long term, the interviewed firms expressed their intentions to diversify their production lines to better meet market demands.

Tourism

In the tourism sector, the companies interviewed revealed that the profession of receptionist is the most occupied by young people and requires a Higher Technician Certificate or a license. Cooks and maids are also common and require baccalaureate and elementary school degrees, respectively.

Table 16: Main occupations for youth (15-24 years) in the tourism sector

Occupations	Number	Diploma
Receptionist	6	BTS/Bachelor's degree
Cook	3	High school diploma
Barman	1	High school diploma
Maid	3	Primary school education

In the tourism sector, receptionists and cooks have the highest skill scores among occupations held by the youth (Table 17). Apart from the systems skills which are less important for cooks, all the other skills appear quite important. Maids require the least amount of skills to perform their job-related duties.

Table 17: Importance of relevant skills required for main youth occupations identified in the tourism sector

	Receptionist	Cook	Waiter	Maid
Basic skills	4.6	4.6	4.2	3.7
Social skills	4.7	4.7	4.3	4.8
Problem solving	4.7	4.7	4.3	4.8
Technical skills	4.4	4.0	4.5	2.3
Systems skills	4.5	3.8	4.0	1.7
Resource management skills	4.8	4.8	4.5	3.9
Mean score	4.6	4.4	4.3	3.5

Horticulture

The interviewed firms mainly produce potatoes, peppers, eggplants, onions, sweet potatoes, mangoes, and limes. In the horticultural sector, the positions held by the youth, as shown by Table 18, are mainly irrigation specialists and agricultural workers, which both require a minimum level of education.

Table 18: Main occupations for youth (15-24 years) in horticultural firms

Profession	Number	Diploma
Head of production	2	BTS
Phytosanitary agent	2	BTS
Irrigation Agent	16	BTS
Florist	3	BTS
Farm hand	11	Some high school
Driver	1	Primary school education

Per the surveys, in the horticultural sector, the phytosanitary agent requires the most skills (Table 19). Irrigation agents and heads of production have the same average skill need. However, a head of production seems to require more systems skills compared to an irrigation agent, who requires more technical skills. Farm workers and drivers essentially require skills for problem solving.

Table 19: Importance of relevant skills required for main youth occupations identified in horticultural sector

	Head of production	Phytosanitary agent	Irrigation agent	Florist	Farm hand	Driver
Basic skills	4.2	4.4	4.6	3.8	3.6	2.3
Social skills	3.8	2.8	3.8	3.7	2.8	2.7
Problem solving	4.0	5.0	4.0	3.0	4.0	5.0
Technical skills	3.0	3.5	3.5	2.8	3.4	2.4
Systems skills	3.5	5.0	1.7	2.0	3.0	2.7
Resource management skills	2.9	3.8	4.0	2.8	3.9	5.0
Mean score	3.6	4.1	3.6	3.0	3.5	3.3

According to interviewees, computer literacy seems also necessary for an effective workforce, especially considering the computerization of the drip system that allows for a more efficient management of resources such as water and phytosanitary products. Computerization would also allow for a better simulation of market needs and thus control risks through a good estimate of production quantities. Thus, in the long run, progressive automation of the production and packaging systems could boost growth by limiting post-harvest losses. In the medium term, horticultural firms aim to increase the scale of production in order to profit from the West African market but also the development of advanced technology—and cultivation of relevant digital skills in workers—for better management of post-harvest activities.

7.2. Skill requirements for the youth: Hard, soft, and digital skills

Understanding the skills required for each occupation in day-to-day tasks is essential for identifying the relevant skill capabilities ultimately required for each of the occupations. Thus, in our approach, we asked respondents to classify and rank skills aggregated into six overarching categories that are consistent with classifications provided by O*NET (2019b). The importance of a skill, measured on a scale of 1 (not important) to 5 (critically important), can be thought of as how critical it is that an individual has this skill in order to complete their day-to-day tasks.

We also classify these categories according to whether they are a “hard” or “soft” skill.

- Basic skills: skills that facilitate learning or the more rapid acquisition of knowledge (soft skill).
- Social skills: skills that are used to work with people to achieve goals (soft skill).
- Problem-solving skills: skills that are used to solve novel, ill-defined problems in real-world settings (soft skill).
- Resource management skills: skills that are used to allocate resources efficiently (soft skill).
- Technical skills: skills that are used to design, set-up, operate, and correct malfunctions involving application of machines or technological systems (hard skill).
- Systems skills: skills that are used to understand, monitor, and improve socio-technical systems (hard skill).

In addition to these skills, the survey also asks about digital skills, defined as “a range of abilities to use digital devices, communication applications, and networks to access and manage information” (UNESCO, 2018). Due to their importance in the current economic climate, these skills are asked about separately in the survey instrument.

Agroprocessing

As shown on Table 20 according to our surveys, food technician is the position held by the youth that requires the most skills, with an average score of 4.1. Respondents noted that, for this profession, basic, systems, and problem solving skills are most important. Accountants and electrical mechanics have relatively similar requirements in terms of skill scores.

The youth occupations in the agro-industry sector require essentially soft skills. Indeed, according to interviews, soft skills are more important than hard skills for professions such as accountant, marketer, and food technician. However, for the profession of electrical mechanic, hard skills are more important. In each of these professions, digital skills are deemed very important, as tasks include sorting and peeling quality seeds, prospecting markets, creating invoices, and managing products and human resources. In the development plans of the companies surveyed, the digitization of production and packaging equipment occupies a prominent place given potential gains in efficiency. One company director surveyed emphasized the role of digital skills, asserting that “individuals without some level of digital literacy would soon be unable to complete the tasks required in youth in the agro-processing industry occupations.”

Table 20: Importance of skills required for main youth occupations identified in the agro-processing sector

	Accountant	Marketer	Electrical mechanic	Food technician
Basic skills	4.0	3.9	4.0	4.0
Social skills	3.2	4.0	3.2	3.9
Problem solving	4.8	4.6	5.0	5.0
Resource management skills	4.0	2.8	3.4	3.7
Technical skills	3.5	1.9	4.7	3.9
Systems skills	4.0	3.3	3.4	4.0
Mean score	3.9	3.4	3.9	4.1

Source: Authors' calculations.

Table 21: Importance of hard and soft skills required for youth occupations in the agro-processing sector

	Accountant	Marketer	Electrical mechanic	Food technician	Mean score
Soft skills	4.0	3.8	3.9	4.1	4.0
Hard skills	3.7	2.6	4.0	4.0	3.6

Source: Authors' calculations.

In the medium term, the interviewed agro-processing firms aim to increase their production capacity as well as the acquirement of additional equipment and the recruitment of qualified personnel. The ECOWAS Common External Tariff (CET), which opens up the West African market, is also an opportunity these agro-processing firms intend to seize by bringing factories closer to areas of production in an effort to lower production costs and thus increase competitiveness.

Tourism

In the tourism sector, receptionists and cooks, among occupations held by the youth, have the highest skill scores. Apart from the systems skills which are less important for cooks, all the other skills appear quite important. Overall, to perform their job-related duties as shown on Table 22, maids require the fewest skills.

Table 22: Importance of skills required for main youth occupations in the tourism sector

	Receptionist	Cook	Waiter	Maid
Basic skills	4.6	4.6	4.2	3.7
Social skills	4.7	4.7	4.3	4.8
Problem solving	4.7	4.7	4.3	4.8
Technical skills	4.4	4.0	4.5	2.3
Systems skills	4.5	3.8	4.0	1.7
Resource management skills	4.8	4.8	4.5	3.9
Mean score	4.6	4.4	4.3	3.5

Source: Authors' calculations.

Apart from the profession of waiter, which requires both hard and soft skills, tourism occupations for youth require essentially soft skills. Indeed, the interviews carried out show a predominance of soft

skills for professions such as receptionist, cook, and maid. Digital skills are also important in tourism youth occupations, especially for the mastery of management software in hotels.

Table 23: Importance of hard and soft skills required for youth occupations in the tourism sector

	Receptionist	Cook	Waiter	Maid	Mean score
Soft skills	4.7	4.7	4.3	4.3	4.5
Hard skills	4.5	3.9	4.3	2.0	3.7

Source: Authors' calculations.

Horticulture

In the horticultural sector, the phytosanitary agent requires the most skills. Irrigation agents and heads of production have the same average skill need. However, the head of production seems to require more systems skills compared to the irrigation agents, who require more technical skills. Skills for problem solving are most important for farm hands and drivers.

Table 24: Importance of skills required for main youth occupations in the horticultural sector

	Head of production	Phytosanitary agent	Irrigation agent	Florist	Farm hand	Driver
Basic skills	4.2	4.4	4.6	3.8	3.6	2.3
Social skills	3.8	2.8	3.8	3.7	2.8	2.7
Problem solving	4.0	5.0	4.0	3.0	4.0	5.0
Resource management skills	2.9	3.8	4.0	2.8	3.9	5.0
Technical skills	3.0	3.5	3.5	2.8	3.4	2.4
Systems skills	3.5	5.0	1.7	2.0	3.0	2.7
Mean score	3.6	4.1	3.6	3.0	3.5	3.3

Source: Authors' calculations.

Computer literacy seems also necessary given the computerization of the drip system, which allows for more efficient management of resources such as water and phytosanitary products. Computerization also opens up more information for assessing market needs and thus control risks through a good estimate of production quantities. In the long run, progressive automation of the production and packaging systems could boost growth by limiting post-harvest losses. In the medium term, horticultural firms aim to increase the scale of production in order to profit from the West African market but also the development of advanced technology for better management of post-harvest activities.

Table 25: Importance of hard and soft skills required for youth occupations in the horticultural sector

	Head of production	Phytosanitary agent	Irrigation agent	Florist	Farm hand	Driver	Mean score
Soft skills	3.7	4.0	4.1	3.3	3.6	3.7	3.7
Hard skills	3.2	4.3	2.6	2.4	3.2	2.5	3.0

Source: Authors' calculations.

An analysis of skills by type shows that, by and large, the horticultural professions occupied by young people require more soft skills than hard skills, with the exception of phytosanitary agent. Moreover, according to the surveys, as modern machinery and equipment used particularly for irrigation and

harvesting systems, digital skills will be increasingly important for horticultural occupations. These digital skills enable the employee to perform a rapid identification of the problems of the irrigation system and, therefore, their resolution.

7.3. Skills gaps of the employed youth

In the interviews, we also inquired into the skills gap for youth hires in each skill category. Indeed, respondents were asked to consider a category of skills and compare the required level of these skills to the level of the skill exhibited by youth hires in the firm. The skill deficit rating is measured on a 5-point scale, with a rating of 1 indicating that most employees met the skill requirements, and as a result, there is little to no skills gap present. In other words, a rating of 5 indicated that most employees did not meet the skill requirements at all and that there was a critical gap present for the relevant skill.

The results show that the skills deficit is more present in the horticultural sector with a score of 2.6 against 2.2 for the agro-processing sector and 2.1 for the tourism sector. The systems skills deficit for youth jobs in the horticultural sector is particularly striking and might be explained by the workforce consisting mainly of agricultural workers with a very low level of formal education. The lack of technical skills is also worrying in the agro-processing sector since the operation of production and packaging equipment requires a mastery of the operating modes of the machines. In the tourism sector, the lack of problem-solving skills for youth occupations could be explained by the scarcity of continuing training in the hotel and restaurant sector. Indeed, according to the tourism sector respondents, training centers far from tourist areas do not facilitate the continuing training of young professionals.

Table 26: Skills deficit by sector

Skills group	Skills deficit value			
	Agro-processing	Tourism	Horticulture	Average IWOSS sector
Basic skills	2.0	2.7	2.7	2.4
Social skills	1.8	2.0	1.7	1.8
Problem-solving skills	2.0	3.7	2.0	2.6
Resource management skills	2.0	1.7	3.0	2.2
Technical skills	2.8	1.3	2.7	2.3
Systems skills	2.3	1.3	3.3	2.3
Aggregate	2.2	2.1	2.6	2.3

Source: Authors' calculations.

8. Policy implications: Unlocking growth potential and overcoming skills gaps

While certain IWOSS in Senegal certainly have the potential for job creation, a number of obstacles stand in the way of the growth of those sectors. Below, we summarize our findings concerning the biggest hindrances to the growth of these IWOSS and provide recommendations on how to overcome those hurdles.

Horticulture:

Having access to credit in Senegal is a lengthy process and has several limitations relative to obtaining credit from commercial banks. Interest rates are high, and barriers to access to credit are not homogenous across sexes. More specifically, women have a harder time accessing loans as all the

parameters relative to having worthy collateral are, most of the time, linked to the borrower's employment status. Moreover, the horticulture sector lacks qualified and skilled laborers that would enable its operators to be competitive in the international markets by producing high-quality products in the timeframe imposed by international buyers. Finally, the impact of climate change on livelihoods cannot be ignored: The natural resources required to have good yields are getting scarcer and the technological investments necessary to allow producers to adapt to those climatic changes are not made. As result, products are not properly conserved nor transformed thus leading to huge yield losses. To counter these aforementioned issues, it would be important to make infrastructural investments to minimize yield losses and increase opportunities for conservation and transformation, provide capacity building opportunities, and develop and popularize climate change adaptation measures.

Tourism:

The biggest issues in the tourism sector are related to climate change, as Senegal has capitalized on “watercourse tourism” where most tourist activities are centered around water. Therefore, rising sea levels threaten most of those activities. Additionally, most investments around tourism are concentrated in big cities like Dakar. The remote rural areas, which also hold breathtaking tourist attractions, lack adequate infrastructure that would attract private investment. Finally, the tourism sector currently has several policies that are not in line with its policy objectives. Thus, policymakers should make important infrastructural investments in rural areas as a means to attract private investments, and identify and implement climate change mitigation measures that would enable a sustainable exploitation of resources.

Agro-industry:

Policymakers must take steps to reduce the barriers to entry to IWOSS sectors, especially lack of adequate infrastructure. For instance, per the World Bank, electric installations can take firms 75 days and cost as much as 3.42 percent of income per capita (World Bank, 2019a). Eight percent of the companies interviewed in the World Bank Enterprise Survey 2014 name electricity as the main constraint to conducting their business activities, and 48.2 percent characterize it as a significant constraint. Furthermore, in an effort to increase profit margins, it is crucial to have access to foreign markets with accessible import and export procedures. In Senegal, exporting a regular container of products requires up to six documents and up to \$1,225 in fees. Importing the same container requires five documents and a \$1,740 fee. Reforms for entry and export of goods are essential for this sector's further growth.

9. Conclusion

In this paper, we have analyzed industries without smokestacks and their potential contribution to economic growth and job creation in Senegal. Our main finding is that this potential is huge and can be further leveraged by adopting some important policies to improve the business environment. Such policies include removing the many hurdles that exist in Senegal's regulatory framework and deter private enterprise development, including: a) highly rigid labor legislation; b) cumbersome and costly tax system; c) still-inhibiting importing system; and d) a weak judicial system and poor contract enforcement environment. Moreover, infrastructure services are also found to be costly and highly unreliable, mainly in the areas of electricity, transportation, telecommunications, etc. These infrastructural deficiencies are highly detrimental to all IWOSS.

Removing these hurdles to IWOSS growth might considerably change the growth trajectory of Senegal in the near future, by, in our estimates, doubling annual growth rates from their baseline level.

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Appendix A: Data sources

Finding data to undertake a thorough analysis of IWOSS sectors' growth and employment patterns in Africa is not an easy task. In this study, we have made use of international data source (WTPP, INSTAT, O*NET). and of data from national sources. In Senegal, it has been made even more difficult by the fact that the country has rebased its GDP in 2018, by adopting 2014 as the new base year. Not only Senegal rebased in 2018, but it also dramatically changed national account classification by allowing for more detailed presentation of sectors than previously. We therefore needed to make sure sectoral data are computed using the same base but also sectoral classifications are uniformized. Below, we present a detailed note on how this has affected our variables of interest in IWOSS and non-IWOSS sectors.

HORTICULTURE

The data on horticulture cover the period between 1995-2019. The directorate of horticulture conducts periodic surveys on predefined sites at the national level. Data on production in tons of seeds and fertilizers are taken from their database. We then converted production, seeds, and fertilizer quantities into kilograms to be able to calculate the monetary value by multiplying the price of a kilogram of speculation by the number of kilograms produced. Thus, the added value is calculated by making the difference between production and intermediate consumption (seeds, Fertilizers, etc.).

Employment statistics were obtained as follows:

The share of added value of horticulture in agriculture is calculated for each year. These proportions are then taken and applied to the total number of jobs to obtain employment in the horticulture sector. It also should be noted that the employment values for the years 2014 to 2018 were available at the national accounts level. These values were used to control the estimated employment for the other years. The following formula was used to calculate employment:

$$g_e = (g_{eT} * \tau) / (1 + \tau)^\alpha$$

g_e : employment level for a given year

g_{eT} : total employment in the agriculture sector

τ : the value added ratio of horticulture to value added of agriculture

α : A coefficient determined by equalizing the level of employment to that of 2018 which is already known

The same principle was used to estimate the added value of the following subsectors whose employment statistics are available and retrievable from the National Statistics and Demography Agency (ANSD) and UNIDO INSTAT, including leather; cotton ginning and textile manufacturing; leather manufacturing and woodworking

The share of employment in the manufacturing sector is calculated then this proportion is applied to the value-added of this same sector to highlight the value-added of the different sub-sectors.

Regarding agro-food products and other sub-sectors, ANSD provided us data on value-added and employment from 1999 to 2013, which we used to calculate the growth rate of value-added and employment for that period. We then calculated the average growth rate that we used to estimate the values from 2014 to 2019.

Regarding tourism, WTTT DATA GATEWAY data for the period between 1995-2019 were used, found here: <https://tool.wttc.org/>

Method of calculating employment from potential employment

The co-integration method is used for the calculation of potential employment, using the formula:

$$E_t = (1 + g_e) * E_{t-1}$$

E_t represents the level of employment in the current period and E_{t-1} the level of employment in the previous period. The parameter g_e is the rate of employment growth from period t-1 to period t. It is calculated as follows:

$$g_e = g_y * \varepsilon_{E/Y}$$

where g_y is the growth rate of the economy and $\varepsilon_{E/Y}$ is the long-term elasticity of employment to production.

The growth rate for each sector is the average growth rate for the last 10 years (2007-2017) which we then consider to be constant over the forecast period.

Elasticity is calculated for agro-processing over the period 1999-2019 using a linear regression model. The same approach was used for the other sectors except tourism and horticulture. For tourism and horticulture, the linear regression method is used over the period 1995-2019.

IMF used this method to calculate labor market indicators in the spreadsheet they developed. See here: <https://www.imf.org/~media/Websites/IMF/imported-publications/external/french/pubs/ft/tnm/2012/tnm1201f.ashx>

Projected number of unemployed

The unemployment rate in 2019 was considered to be the unemployment rate over the forecast period. ANSD's demographic projections (2013-2063) were then used with potential employment to estimate the number of unemployed in 2030.

To construct distribution keys to be able to distribute the estimated potential employment, three data sets were used, notably: the Senegalese National Survey on Employment (ENES), the second wave of Monitoring of Households Survey (ESAM II), and the data sets on employment and unemployment available on the ILOSTAT website are used. Several distribution keys have been constructed from these different data sources. These keys are:

- Distribution of employees by gender (ENES and ESAM survey)
- Distribution of employees according to profession (ENES and ESAM survey)
- Distribution of employees according to level of education (ENES and ESAM II survey)
- The working age population (ENES and ESAM II survey, ILOSTAT 2020)
- The unemployment rate (ENES and ESAM survey, ILOSTAT 2020)
- Youth unemployment rate (ENES and ESAM II survey, ILOSTAT 2020)

ILOSTAT data can be found here: <https://ilostat.ilo.org/data/>

ESAM II:

The Senegalese Household Survey (ESAM) is a national survey on household consumption and expenditure. The first was carried out in 1994/95 and involved a sample of 3,300 households. The second, carried out in 2002/2003, was designed to provide information on households living in Senegal regardless of the area of residence (urban or rural). The 2002/2003 survey covers 6,600 households spread across the national territory and representing all social strata of the country.

ENES:

The National Survey on Employment in Senegal (ENES) is carried out by the National Agency for Statistics and Demography (ANSD). The data collection took place over the period between June 14 to July 18, 2015. This survey constitutes the first annual production of a series of employment surveys which have been produced throughout each year on a quarterly basis since 2016.

The ENES aims to measure labor supply and demand. It makes it possible to measure the categories of activities relating to employment and unemployment (employed population, active population, unemployed, underemployment, etc.), to specify their characteristics (average duration of occupation, multiple activities, etc.) and structure to analyze the profile of employed workers (level of education, level of qualification or professional training, etc.), and to assess the safety of people employed in their workplaces.