IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international

Canada

DEVELOPMENT POLICY RESEARCH UNIT

Senegal`s International Competitiveness and Employment Creation for Women and Youth

The Product Space Analysis and Fieldwork Findings

by Stephen Golub, Ahmadou Aly Mbaye and Anastasia Vasilyeva
2019

Report commissioned by the "*Building economic complexity in Africa: Laying the foundation for expanding economic opportunities for women and youth in Africa*" project.

Senegal's International Competitiveness and Employment Creation for Women and Youth
The Product Space Analysis and Fieldwork Findings

Stephen S. Golub
Swarthmore College

Ahmadou Aly Mbaye
Cheikh Anta Diop University of Dakar

Anastasia Vasilyeva
Swarthmore College

Final August 2018

Abstract

Senegal benefits from political stability and a favorable geographic location, but economic performance since independence has been disappointing, with resulting pervasive underemployment, especially for women and youth. This policy brief assesses the prospects for boosting employment through export-led growth, making use of the product-space framework. The central concept is to diversify exports into increasingly "complex" products embodying sophisticated capabilities. We depart from the usual product-space approach, however, in arguing that Senegal can foster increasing complexity and employment growth *within* existing product lines with strong comparative advantage by improving product quality and cost-competitiveness. To do so will require addressing long-standing weaknesses in the business climate, particularly deficient public services, corruption and restrictive labor market regulations.

Acknowledgements:
Prepared for the Development Policy Research Unit of the University of Cape Town. We thank Haroon Bhorat, Francois Steenkamp, and other members of the DPRU team for comments and assistance, and an anonymous reviewer for comments. Kazuatsu Shimizu and Jorge Tello provided very helpful research assistance.

Contents

1 Introduction: the Senegal Paradox

In this paper, we study Senegal's participation in the world economy and implications for employment opportunities through use of the product space framework and follow-up detailed analysis of industries with promising export potential. The product space provides a convenient and synthetic framework for analyzing a country's export pattern and suggesting possible diversification options and thus structural transformation of the economy. In a number of studies, Hausmann and his colleagues have explored the relationship between a country's export composition and its economic development. They found evidence that wealthier countries tend to export more diversified baskets of goods that include technologically complex products. Their findings suggest that the path to prosperity passes through export diversification. In this study, we apply methods developed by Hausmann and his colleagues to analyze Senegal's export structure and help identify areas of actual and potential comparative advantage and more specifically those sectors with greatest opportunities for boosting employment of women and youth.

However, it is also important to understand the limitations of the product space framework for small low-income countries with very limited export structures. While the product-space is based on the concept of capabilities, these are measured indirectly through measures of revealed comparative advantage (RCA), based on actual exports. Patterns of RCA are a useful starting point in ascertaining productive capabilities, but awareness of the limitations of the data are very important. In particular, many products which have apparent positive RCA are often simply re-exports of imported products. It is therefore essential to use prior knowledge of the economy and on-site investigations to understand the most promising avenues for export diversification and structural transformation.

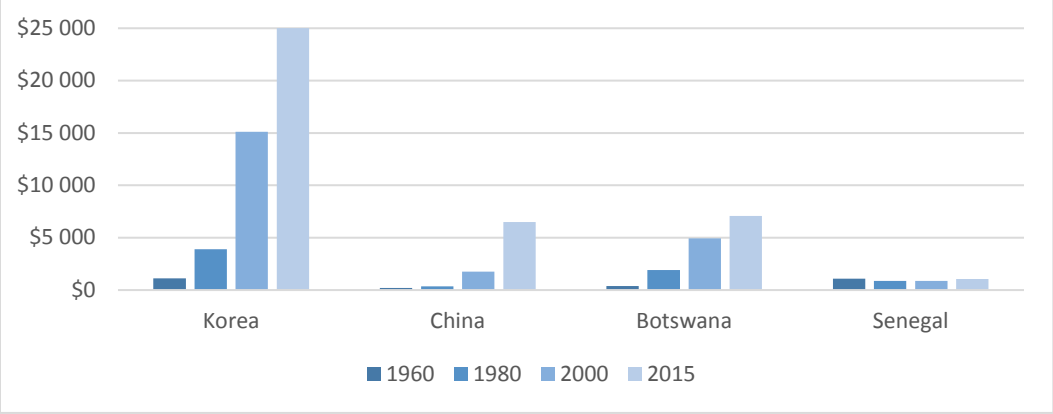
Senegal is one of the most stable democracies in Africa, with fair elections, ethnic harmony and religious tolerance. The country is well situated on the coast of West Africa to access markets in Europe and North America. Its limited resource endowment has shielded it from the "resource curse" of economic distortion, corruption and violence associated with mineral rents. While rainfall is erratic, irrigation potential is considerable. Yet economic performance since independence in 1960 has been disappointing. Social indicators such as life expectancy and literacy have improved, but per capita real GDP is barely above the level of 60 years ago, poverty remains pervasive and underemployment in the informal sector is the norm. Using the World Bank thresholds of poverty of $3.10 per day, two thirds of the population were poor in 2011, nearly

unchanged from 2005 although somewhat better than in the early 1990s when the rate was over 80%. Meanwhile, less than 10% of the workforce is employed in private and public formal sector jobs with regular salary, health and retirement benefits and other social protections (Golub and Hayat 2015).

Figure 1 shows real per capita GDP for Senegal and a few other developing countries, Korea, China and Botswana. In 1960, Senegal's per capita GDP was about the same as Korea's at $1000 2010 US dollars. China and Botswana's per capita GDP were well below that. Fast forward to 2015, and Senegal's per capita GDP is around the level in 1960. Meanwhile Korea has become a developed country and other East Asian countries have far surpassed Senegal. In Africa, success stories such as Botswana and Mauritius have also done well, showing that rapid growth is not exclusively an Asian phenomenon.

The consequences of this lackluster growth for employment and well-being have been devastating, especially for youth and women. The vast majority of the labor force is confined to the informal sector, characterized by very low incomes and minimal job security (Golub and Hayat 2015; Golub, Mbaye and Chwe 2015).

Figure 1: GDP per capita (constant 2010 US$)



Source World Bank World Development Indicators

What explains this dismal economic performance in the face of seemingly favorable geographic and political circumstances and what can be done about it? The historical evidence is clear that rapid growth, structural transformation, and employment creation in the formal sector require integration into the world economy through exports of labor-intensive goods, even if the exact nature of that integration and the policies that foster it may differ somewhat from country to

country (Golub, O'Connell and Du 2008). And integration into the world economy requires global competitiveness. So, what is holding back Senegal's competitiveness? This is an issue the authors of this paper have addressed previously (Golub and Mbaye 2002; Mbaye and Golub 2003; Golub, Ceglowski, Mbaye and Prasad 2018). Other recent contributions on Senegal's economic performance and international trade include IMF (2017), English (2016), MCC (2017), Mbaye and Gueye (2015).

The remainder of the paper is organized as follows. Section 2 provides a brief overview of Senegal's economic history and policies since Independence. Section 3 describes Senegal's dismal employment situation, particularly regarding women and youth. Section 4 outlines the product space methodology. Section 5 provides a macroeconomic perspective on Senegal's exports. Section 6 applies the product space methodology to Senegal's export structure, in an effort to discern those sectors that have actual and potential comparative advantage and are labor-intensive. Section 7 discusses the most promising sectors that emerge from the product space analysis. Section 8 concludes with an overall assessment and policy recommendations.

2 Overview of Senegal's Economic Performance and Policies since Independence

In the first two decades following independence in 1960, under President Leopold Senghor, Senegal adopted a policy inspired by "African Socialism" and the then widely-accepted import-substitution model, involving high levels of import taxation and widespread government intervention in markets, benefiting incumbent (often French-owned) firms and restricting competition (Geller 1995; Mbaye and Golub 2003; Golub and Mbaye 2002; Cissé, Choi and Maurel 2014). Even for that era, Senegal's policies involved an extraordinary degree of complexity, intrusiveness, and discretion, providing substantial opportunities for corruption and rent-seeking behavior. As a result of its role as the capital of colonial French West Africa and the high levels of protection in the post-Independence period, Senegal had a relatively developed albeit inefficient industrial base for light industry, particularly textiles (Boone 1989).

Senegal has also maintained a fixed exchange rate as part of the West African Economic Monetary Union (WAEMU) with common currency--the CFA franc--pegged to the French Franc and subsequently the Euro[1]. The high levels of economic inefficiency and corruption combined with an overvalued exchange rate inhibited Senegal's exports and contributed to a balance of payments crisis in the early 1980s. Smuggling via The Gambia became endemic (Boone 1989, Golub and Mbaye 2009). Beginning in the late 1980s, Senegal instituted a series of reform packages, liberalizing trade and promoting exports. These reforms had limited success in boosting competitiveness and exports. The 1994 devaluation of the CFA franc by 50% along with further reforms succeeded in raising growth moderately to an average of 4.5% for the next decade, leading to small increases in per capita income that partially offset the decline during the 1980s crisis (English 2016).

Even before the end of the import-substitution era, Senegal adopted a number of measures to spur exports and industrial development, including the Dakar Industrial Free Trade Zone (ZFID) established in 1974 within which firms could benefit from a variety of incentives for exporting. The ZFID was unsuccessful in attracting export-oriented foreign or domestic investment. From the 1980s to the present day there have been numerous subsequent government initiatives and strategies to promote export diversification and growth, and they too have had limited success at

[1] WAEMU replaced the West African Economic Monetary Union (WAMU) in 1994.

best. These included the New Industrial Policy (NPI) in 1986, the reforms associated with the 1994 devaluation, particularly the Private Sector Adjustment and Competitiveness Operation (PASCO), and the WAEMU Common External Tariff (TEC) instituted in 2001 which greatly simplified and reduced import taxation. These reforms and liberalization measures spurred imports but largely failed to catalyze the hoped-for export and foreign investment boom. Instead, many of the inefficient incumbent firms collapsed, replaced by the mushrooming informal sector rather than formal domestic and foreign firms. Smuggling continued unabated. The underlying problem was that trade liberalization in the context of an adverse business climate and a clientelistic state is insufficient and perhaps even counterproductive. Likewise, export promotion is unlikely to succeed in a context of complex and burdensome regulations, favoritism, corruption and dysfunctional infrastructure. Thus, Senegal's largest industries—groundnuts, fishing and textiles—stagnated or collapsed (Golub and Mbaye 2002, Mbaye 2002). Only those import-competing sectors that retained high levels of protection—sugar, vegetable oil and flour—managed to stay afloat, although even the highly subsidized groundnut oil producer SUNEOR recently went bankrupt (Mbaye, English and Golub 2016).

In the 2000s, the governments of Abdoulaye Wade and Macky Sall continued the Senegalese tradition of announcing ambitious plans to promote private-sector development and transform Senegal into an emerging market. Wade's 2005 Stratégie de Croissance Accélérée (SGA) targeted industrial "clusters" in sectors such as agriculture, light manufacturing, tourism and telecommunications, with little discernible effect. Meanwhile Senegal continued to rank near the bottom of the World Bank Doing Business indicators and other measures of the business environment. Most recently the Sall administration has unveiled the Plan Sénégal Emérgent (PSE) which, as the name suggests, aims to make Senegal an emerging economy through high and inclusive growth, targeting similar sectors as identified by the SGA (English 2016, IMF 2017). Unlike some of the previous plans, the PSE is showing some signs of success as Senegal has experienced strong growth in 2015-2018. Perhaps not coincidentally, Senegal's rank in the Doing Business indicators has improved from 178th out of 189 countries in 2013 to 147th in 2016 (English 2016). Clearly, however, Senegal has a long way to go to reach the elevated status of emerging economy.

3 The Labor Market, Youth and Gender Equality

Senegal's weak economic growth combined with unabated population expansion has translated into a growing gap between labor supply and demand and thus bleak employment prospects, especially for women and young people (Golub, Mbaye and Chwe, 2015). The Senegalese population increased by over 50% over the last 15 years to 15.5 million people in 2016. Formal employment opportunities have not kept pace. The growing working age population has almost entirely been absorbed into the informal sector, in agriculture and especially in urban areas. As a result, living standards and economic prospects for young people are dismal. As a recent Millennium Challenge Corporation report (MCC 2017) points out, for much of the population, the situation has barely improved over the last 20 years.

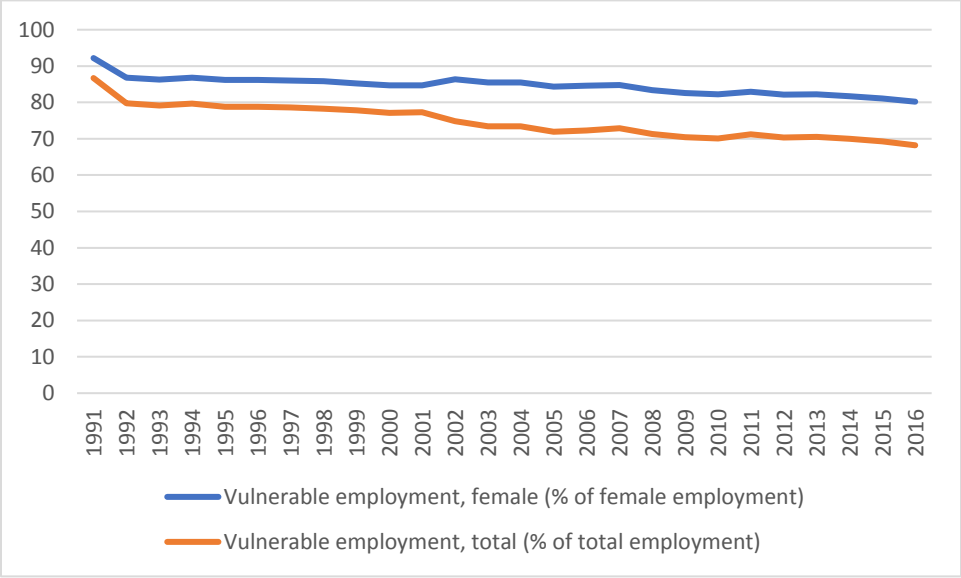
Employment is thus overwhelmingly in the informal sector in Senegal as in other low-income African countries (Benjamin and Mbaye, 2012; Golub and Hayat, 2015). For a working age population over 8 million and a labor force of about 6 million, there are only about 500,000 formal sector employees in the public and private sectors receiving regular pay and benefits. Along the same lines, ANSD (2016) reports that over 95% of employers and independent workers are informal.

Also, as in many other Sub-Saharan African countries, the distinction between unemployment, discouraged workers and informal-sector employment is hazy in Senegal. Employment as a share of the working population in 2015 in Senegal was reported by ANSD (2016) at 59% for men and only 32.8% for women. Less than 10% of the labor force is employed in the formal sector, over 75% work in the informal sector, and the remaining 15% is unemployed, i.e., reported in the labor force and actively looking for work. Official unemployment was higher for women (22.6%) than men (9.8%) in 2015. Measured underemployment, defined as involuntarily working part time, is also considerably higher for women than men, at 39% and 20% respectively (ANSD 2016). These official estimates of unemployment and underemployment do not count the large number of people working in largely unpaid capacities within households, including family members and servants.

The International Labor Organization (ILO) measure of vulnerable employment provides a partial measure of the extent of informality. Vulnerable employment is defined as self-employment and family workers. These workers account for the overwhelming share of employment in Senegal, although the share of vulnerable employment has declined somewhat over

the last two decades from around 90% to 70% for all workers (Figure 2). For females, the share is even higher and has declined less, remaining at about 80% in 2016.

Figure 2: Share of Vulnerable employment, in total employment (%)



Source: ILOStat.

A minority of workers receive a regular salary; the rest are paid by the task or irregularly. A further indicator of the extent of informality is that only 20% of employees are paid by check or direct deposit. The majority are either paid in cash, in kind, or not remunerated at all (ANSD 2016). The share of workers receiving benefits is likewise low. ANSD (2016) reports that about 15% of employees have medical insurance and retirement plans. Considering that these figures do not include people out of the labor force—mostly household workers—the share of the population covered by social safety nets is even lower.

Over the last 30 years, employment creation in the formal private sector has stagnated while the public sector has shed jobs. Most recently, improved economic growth in Senegal, led by non-tradable sectors such as construction, commerce, communications, and information technology, has boosted formal employment moderately. However, about 2/3 of these contracts are temporary (Golub, Mbaye and Chwe 2015). In contrast, in 1980, about 60% of employment contracts were indefinite (Terrell and Svejnar 1990).

For women and young people, the labor market situation is especially difficult. While education levels have been rising, in 2011 46% of young people (ages 15-35) still lacked formal

education. 40% of young people classified as outside the labor market are "discouraged workers" who have ceased looking for work due to poor prospects. Those that do have jobs are overwhelmingly in the informal sector (Ministère de la Jeunesse 2014).

Although Senegal's constitution guarantees gender equality, women and girls are disproportionally affected by poverty. In 2014, Senegal's SIGI Index was estimated at 0.1985 placing the country in the category of medium gender equality; Senegal's score was 63rd in the world and 11th in Sub-Saharan Africa.[2] Family code and physical integrity were the areas in which Senegal showed the weakest performance. Especially in the rural areas, women experience discrimination in the domains of education, inheritance, and gender roles within family. Women suffer from domestic violence, genital mutilation, and limited reproductive rights including restrictive abortion regulations.[3] Women face obstacles in completing their education, possess little authority in decisions regarding marriage or land acquisition, face unfair inheritance laws, and have little access to formal employment opportunities.[4] While many of these issues are deeply entrenched in local traditions, they can be combated gradually through women's economic empowerment along with more effective enforcement of laws that protect gender equality. More active female economic participation will result in increased financial independence and greater political power which will act to reduce the gender gap in Senegal. Women's empowerment is known to start a positive reinforcement cycle of economic development and lead to more rational choices regarding family planning and raising the next generation which highlights tremendous economic benefits of encouraging women's employment.

While the informal sector provides livelihoods of last resort to millions of people, it is usually characterized by low incomes, lack of benefits and no security. Earnings of informal sector workers average about one quarter of the earnings of public sector employees and one third of formal private sector workers (Benjamin and Mbaye, 2012; Golub and Hayat, 2015)[5]. The

[2] OECD Social Institutions and Gender (SIGI), Index Senegal, 2014: http://www.genderindex.org/country/senegal/

[3] OHCHR, Women in Senegal: breaking the chains of silence and inequality. 17 April 2015 http://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=15857&LangID=E

[4] Africa for women's rights. Senegal http://www.africa4womensrights.org/public/Dossier_of_Claims/SenegalENG.pdf

[5] In some large informal sector firms, wages are closer but still below those of the formal sector (Benjamin and Mbaye 2012).

unsatisfactory nature of informal sector employment and continuing gender inequalities highlight the critical importance of creating formal job opportunities.

4 The Product Space Methodology for Identifying Actual and Potential Comparative Advantage

An increasing consensus has developed on the importance of export growth and diversification for economic development. All exporting of course brings foreign exchange. However, some exports are more conducive to structural transformation and equitable growth than others. Natural resource extraction and distribution is capital-intensive with relatively few positive spillovers to the rest of the economy. Manufacturing and agriculture are more subject to technological progress, forward and backward linkages with other sectors, and employment creation, including for women and youth. The employment issue is of critical importance in countries with young and rapidly growing populations, and empowerment of women is of central importance in its own right and as a way of fostering the demographic transition to lower birth rates. It is well known that the East Asian "miracle" was based on export-led growth of labor intensive manufacturing. Export-oriented agriculture, fishing and tourism can also play a transformative role for much the same reasons: employment creation and quality upgrading through participation in global value chains (Golub, O'Connell and Du, 2008; Golub, Bernhardt and Liu, 2011).

Hausmann and various collaborators (Hausmann, Hwang and Rodrik 2007, Haumann and Klinger 2007, Hausmann and Hildago 2011) have developed a framework for analysis of exports, centered on the concept of economic complexity. In recent years, they have refined and developed empirical methods and data for measuring the quality and potential of exports through The MIT Atlas (Hausmann and Hildago *et al*, 2011), an interactive open platform that enables analysis of the composition of international trade for developing countries. It has been applied to many developing countries but only to a limited extent in Senegal.

The theory of economic complexity is based on the notion that products are created with knowledge. Each good can be thought of as a manifestation of productive knowledge and capital that was used in its creation. These ingredients are known as capabilities; an economy grows by creating a network of related capabilities across the workforce, which enables it to produce new kinds of goods. The combination of goods produced by an economy contains information about this economy's complexity level and potential industries for expansion. Economic complexity of a country essentially refers to the abundance and level of sophistication of its capabilities measured

by diversity of its export structure and the ubiquity of the products comprising its exports. Diversity of a country's exports refers to the number of different products the country makes, it can be thought of as a vector with entries corresponding to all traded products; an entry assumes the value of 1 if the country produces the corresponding product and 0 if it doesn't. Thus, high diversity signals that a country produces a large number of products that implies one of the two following scenarios: the country is either economically complex and has a lot of productive capabilities or this country has rich natural resource endowment and produces a lot of simple products that don't require complex knowledge and capital. In order to determine which of the scenarios is true for a specific country, we need to measure the ubiquity of each product comprising the country's exports. Ubiquity of a product is estimated by the number of countries that produce that product, it can be represented by a vector with 1 for entries corresponding to countries that produce this product and 0 for entries corresponding to countries that don't. Low ubiquity of a product can arise due to the high capability requirement, like in case of complex machinery, or due to the scarcity of inputs, like in the diamond industry. Creating a precise estimate of the number of production capabilities available to an economy or required to produce a product involves taking measures of one indicator (diversity or ubiquity) and correcting that information using the other indicator. For example, to determine economic complexity of a country we must calculate the average ubiquity of the products it produces, multiply it by the average diversity of countries that produce each of those products, and so on. A country with diverse products that have low ubiquity scores high on the Economic Complexity Index (ECI). In 2015, the country with the highest economic complexity, Japan, had an ECI score of 2.35 and the country with the lowest complexity, Sudan, had an ECI of -1.87. Similarly, to calculate the economic complexity of a product, we much measure the diversity of countries that produce the said product, correct that information by the ubiquity of all other products that those countries produce, and so forth. A product that has low ubiquity that is produced by countries with high diversity scores high on the Product Complexity Index (PCI). The most economically complex product of 2015, metalworking machine-tools, had a PCI of 2.62 and the least complex product, sesame seeds, received a score of -2.97.

This system also provides a way to quantify the "distance" to a new product, i.e., the similarity between the capabilities that a country already possesses and those that underlie production of a product that may present a potential diversification opportunity. This is important because it allows us to estimate how easily a country can start producing a new product thereby

providing clues about actual and potential comparative advantage. Calculation of distance relies on the measure of proximity between products. Proximity between two products refers to the similarity of capability requirements between these two goods. While required capabilities cannot be measured directly, they can be inferred by the frequency with which two products are produced by the same country. That is, if two products are often produced together, these two products are said to have high proximity and thus likely having similar capability requirements. Distance to a product P for a country C is defined as the inverse of the sum of proximities between all products that country C produces and the product P. Thus, if a country already produces many goods that require similar capabilities as the product P, the distance to that product will be small, which means that it would be easy for the country to start producing product P since it will only need to obtain a few additional capabilities required for production of P. However, if the products a country makes have few shared requisite capabilities with the product P and the distance to P is large, it would be difficult for the country to diversify into production of P. This logic allows us to identify potential diversification routes by considering the products that are close to the ones that a country already produces.

Economic complexity refers to the production characteristics rather than exports. Unfortunately, for many developing countries, including Senegal, consistent sectoral production data are not available, so researchers had to construct the product space based on international trade data. Despite the fact that economies don't export everything they produce, theory suggests that countries export products that they have a comparative advantage in, which makes trade data an acceptable approximation for production data. Furthermore, as noted previously, both theory and empirical observation point to the importance of exports in fostering development.

The product space is a graph consisting of nodes that represent major traded products and connections that measure proximity between them (in order to preserve legibility, only the strongest 1% of links is shown). For each country, the nodes that represent goods with a Revealed Comparative Advantage (RCA) greater or equal to 1 are shaded, while other nodes are left blank. This design allows to quickly assess each country's complexity level: a greater amount of shaded nodes and higher concentration of shaded nodes in the well-connected center of the product space corresponds to higher levels of economic complexity. Typically, less developed and less diversified economies tend to have fewer shaded nodes that are mostly located on the periphery of the product space. RCA is defined in equation (1) for home country c and product p. X_{cp} are

exports of country C of product p. $RCA_{cp} > 1$ for product *p* if the country exports a larger amount of that product than the amount predicted by its economic size and the product's share of global trade.

$$RCA_{cp} = \frac{X_{cp}}{\sum_c X_{cp}} \Big/ \frac{\sum_p X_{cp}}{\sum_{c,p} X_{cp}} \quad (1)$$

While the product space framework and accompanying export data provide a valuable resource, there are also several limitations for purposes of assessing the value of a certain product for promoting development.

First, there may be a negative relationship between a product's complexity and its labor-intensity. Since the main agenda of this study is identifying diversification opportunities that could decrease unemployment among women and youth, the diversification products of greatest importance may not coincide with those with high PCI. For this reason, capital-intensive products will be excluded from the final recommendation since their development cannot contribute to employment creation. Petroleum refining and chemical products are cases in point as discussed further below.

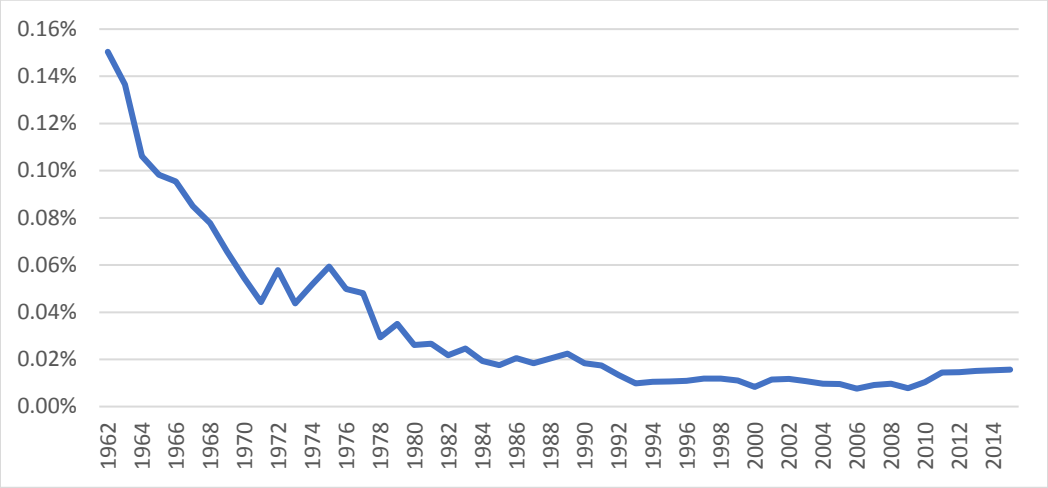
Secondly, export data can sometimes be misleading if examined in isolation from imports. A country can have $RCA_{cp} > 1$ for product *p,* yet have a large trade deficit in that product. In particular, in Africa especially, sometimes countries re-export goods they imported from abroad with minimal value added. Thus, we also exclude products whose import value is equal or greater than their export value from our analysis. Petroleum products could also be excluded on this criterion as well.

5 Senegal's International Trade: Macro Trends

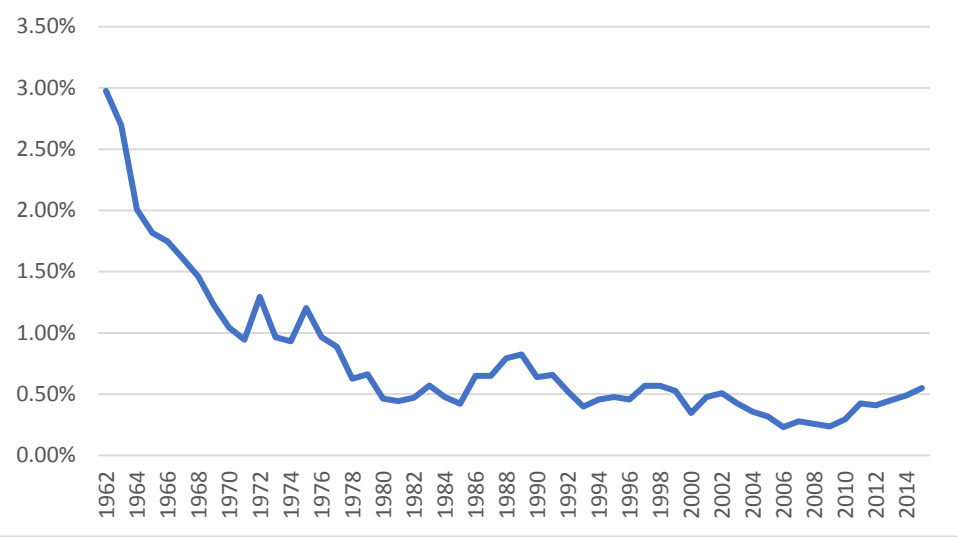
Senegal's exports have grown much more slowly than global trade or even African trade. Figure 3a shows that Senegal's share of global exports has dropped precipitously since the early 1960s from about 0.15% to 0.01% in the 2000s, then edging up in the last few years to close to 0.02%. Senegal's share of African exports also plummeted from about 3% to 0.5% between 1962 and 2014 despite the fact that Africa's share of world exports itself fell by about half over this period (Figure 3b).

Figure 3. Senegal's Dwindling Share of World Exports

a. Senegal's Share of World Exports (Percent)



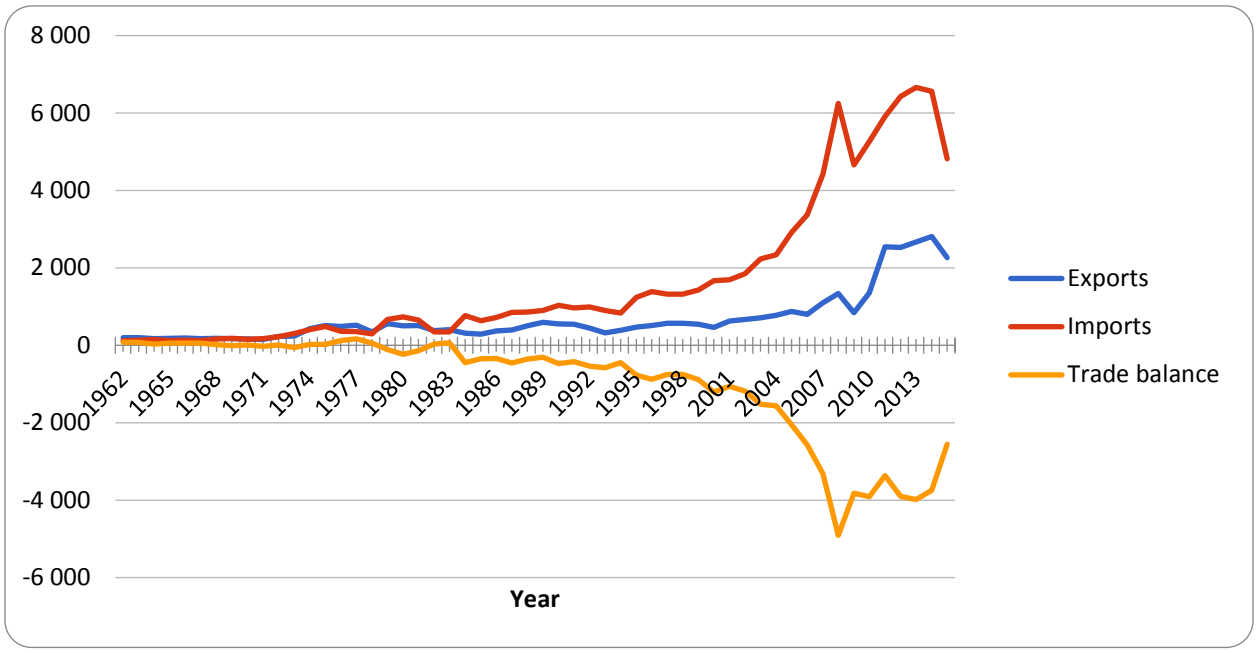
b. Senegal's Share of Total African Exports (Percent)



Source: MIT Atlas

A further manifestation of Senegal's lack of competitiveness is its ever-widening trade deficit. Senegal's imports have steadily surged ahead of exports leading to sustained trade deficits funded by inflows of foreign aid, remittances and official loans (Figure 4).

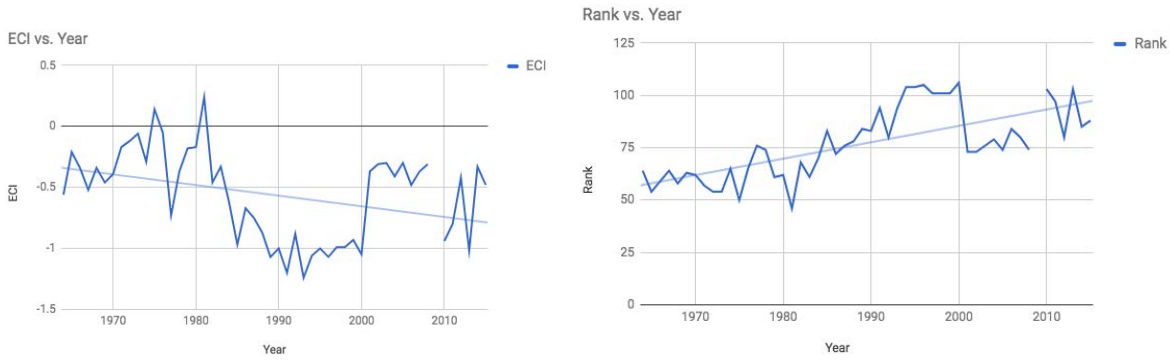
Figure 4. Senegal's Exports, Imports and Trade Balance ($ Millions)



Source: MIT Atlas

Another concern arises from Senegal's declining complexity index (ECI) since the 1960s (Figure 5). Senegal's ECI level fell between 1980 and 2000 and then recovered somewhat over the last 15 years. Senegal has steadily dropped in the ECI country ranking over this time, as other countries raised their complexity while Senegal lagged.

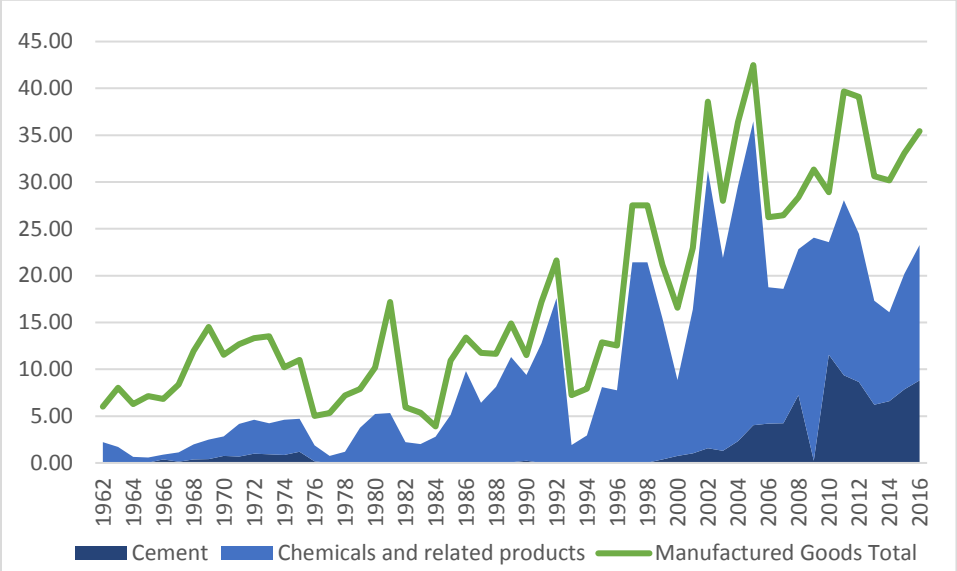
Figure 5. Senegal's Economic Complexity Index (ECI) Score and Rank over Time



Source: MIT Atlas

Senegal's manufacturing exports have risen over time as a share of total but the preponderance of manufactured exports consists of chemicals related to phosphates and cement, two capital-intensive sectors (Figure 6).

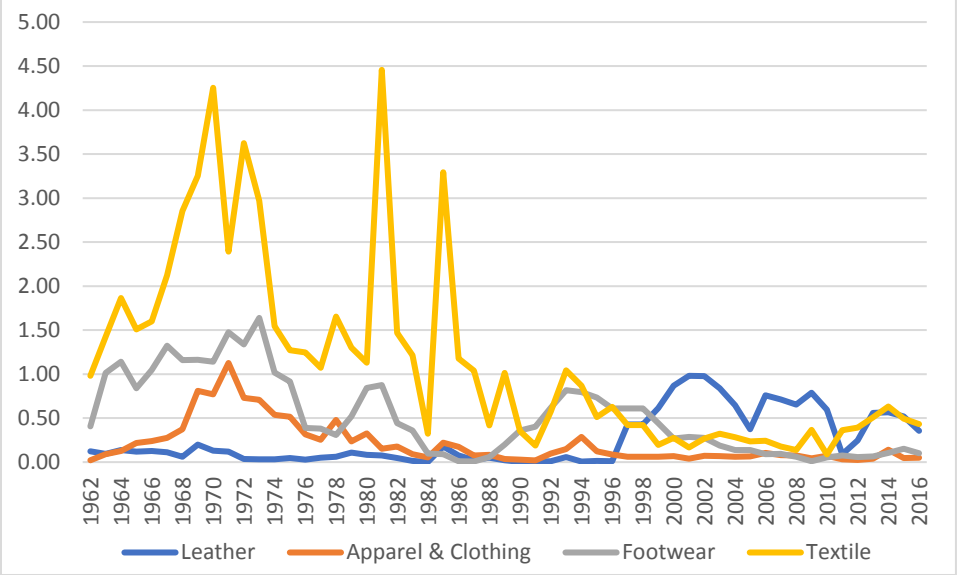
Figure 6. Senegal: Total and Main Manufactures Exports (% of Total Exports)



Source: Author's calculations based on UN Comtrade data.

Exports of the most basic labor-intensive manufacturing such as textiles, clothing and shoes, however, have declined sharply over time (Figure 7). Textile exports were fairly substantial in the first few decades after Independence but dropped sharply since the late 1980s. Leather exports have risen moderately since 2000.

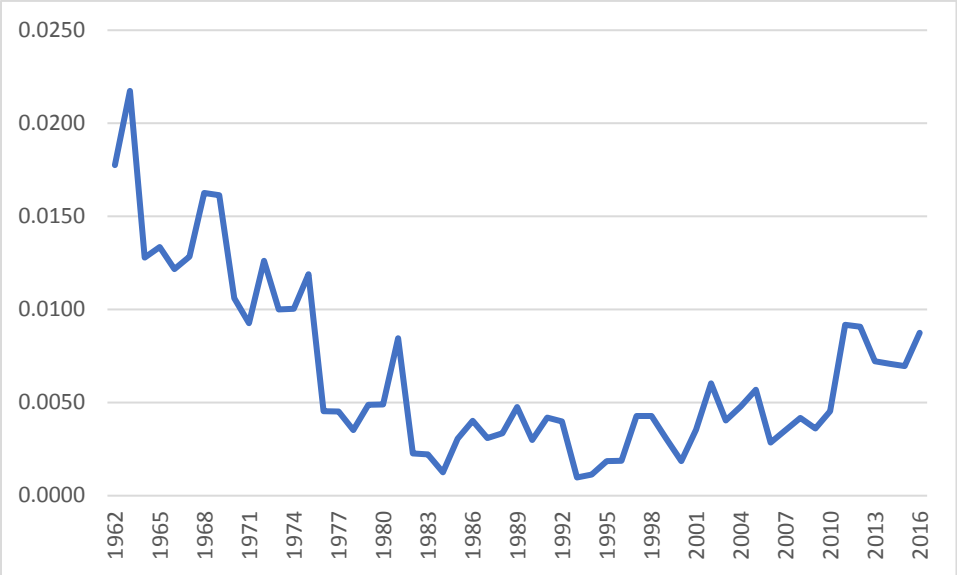
Figure 7. Senegal: Exports of Labor-Intensive Manufactured Exports (% of Total Exports)



Source: Author's calculations based on UN Comtrade data.

As a share of world exports, Senegal's exports of manufactured exports are even less impressive (Figure 8), dropping steadily in the 1960s and 1970s to very low levels with a small recovery since 2000 due mainly to exports of chemicals, as seen in Figure 6.

Figure 8. Senegal's Manufactured Exports (% Share of World Manufactured Exports)



Source: Author's calculations based on UN Comtrade data.

Overall, Senegal's export performance has been quite disappointing and more dynamism is necessary if the country is to succeed in its goal of reaching emerging economy status. This finding is not novel and was pointed out in our earlier work (Golub and Mbaye 2002, Mbaye and Golub 2003) as well as others (English 2016, IMF 2017). In this paper, we hope to advance the literature through the use of the product-space methodology described above, which to our knowledge has not until now been systematically applied to Senegal. This approach allows for a comprehensive perspective on export possibilities and sets the stage for evaluating the potential of various sectors in Senegal's economic transformation and employment creation.

6 Product Space Analysis of Senegal's Exports

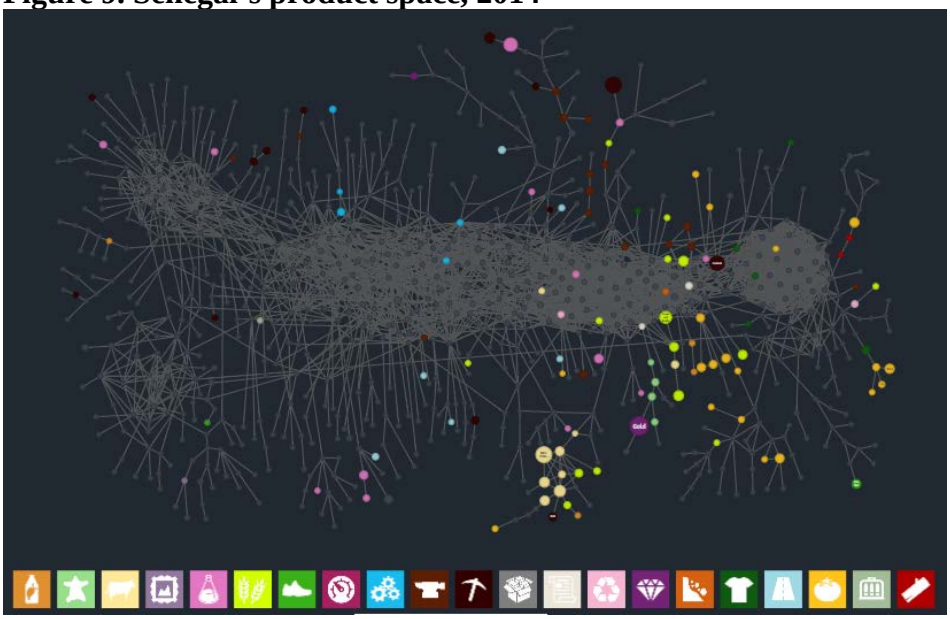
6.1 Evolution of Senegal's Comparative Advantage

This section focuses on evaluating Senegal's main export sectors and identifying potential export opportunities based on their proximity to the already established industries and their potential for female and youth employment. Our analysis of current export composition as well as its development over time will enable us to ascertain the most promising industries. The data are all from the MIT Product Space Atlas, and uses the framework described in section 4.

Figure 9 displays Senegal's product space. Colored dots indicate Senegal's exporting industries. Lines connecting the dots indicate industries that are "close" and therefore of possible consideration as diversification options, using the above described definition of proximity.

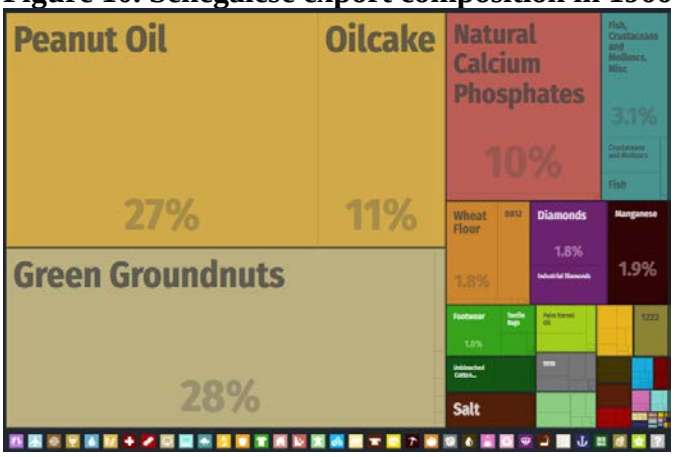
In the 1960s, Senegalese exports were dominated by groundnut products including peanut oil, edible peanuts, and oilcake (Figure 10). At that time, Senegal was one of the world's largest exporters of peanut oil. This sector remained important throughout the next 50 years, but has experienced many difficulties and currently is facing an existential crisis, as discussed more fully below. Senegal also displayed potential in other primary products that, despite their low complexity index, play a central role in many developing countries' economies. Among these products were cocoa beans, coffee, and diamonds. However, by the mid-1960s many of these sectors largely disappeared while phosphate mining and related chemical industries increased in importance.

Figure 9. Senegal's product space, 2014



Source: MIT Atlas

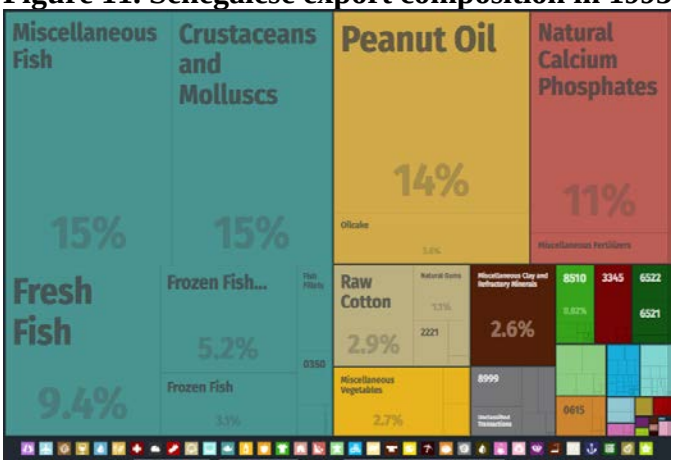
Figure 10. Senegalese export composition in 1966



Source: MIT Atlas

In the 1980s, fishing experienced rapid growth in Senegal. By the early 1990s, fishing became the single most important export sector and continued to constitute 40-50% of all exports until the early 2000s (figure 11). During this time, peanut products, cotton, phosphates, fertilizer, and phosphoric acid were also exported with large positive RCA scores.

Figure 11. Senegalese export composition in 1993

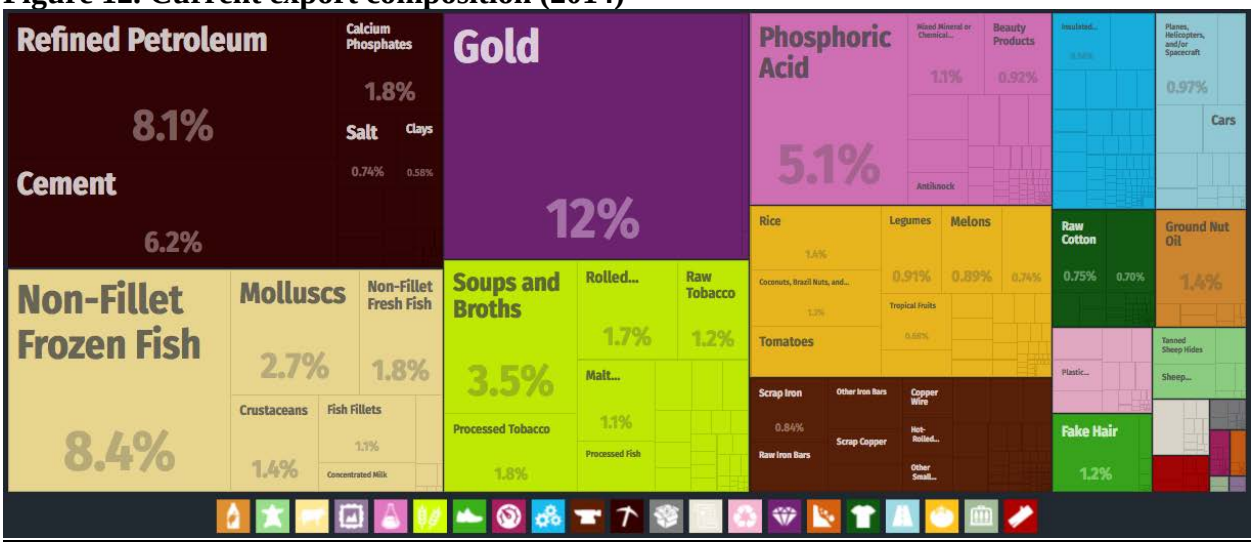


Source: MIT Atlas

In the mid-2000s the role of fish and other seafood exports became significantly less pronounced as other industries started to exhibit rapid growth and overfishing became an increasing problem, as discussed below. Though fish, chemicals, and peanut products remained important exports, we can observe a considerable expansion of processed food, cotton, tobacco, cement, and gold.

In the last decade, Senegal was able to further diversify its exports (figure 12). In addition to fish and chemicals, it now exports gold, cement, hides, tobacco products, cotton, and various foods including nuts, legumes, vegetables, and food products. Meanwhile, Senegal continues to import a wide range of goods including machinery, electronics, fabrics and clothing, medicaments, rice, and other food products.

Figure 12. Current export composition (2014)



Source: MIT Atlas

6.2 Senegal's Product Space and Diversification Opportunities

Our objective is to discern promising export diversification opportunities in Senegal with a view to boosting employment, particularly of women and youth. Thus, the sectors in question must not only have strong potential comparative advantage but must also be labor-intensive. For a labor-abundant country such as Senegal, comparative advantage and labor-intensity ought to coincide but in practice often does not, as we will see.

About 150 products with RCA>1 appear in the product space for Senegal, with some variations depending on whether the SITC or HS system of classifying goods is used. These are listed in Appendix 1 for the HS classification. The largest of these, accounting for at least 0.5% of exports, are shown in Table 1. Table 1 shows the product category, the name of the product, the value of exports and imports in millions of US dollars, the product's share of total Senegalese exports, and Senegal's Revealed Comparative Advantage in that product (RCA).

A large number of the products displayed in Table 1 and Appendix 1 manifestly do not satisfy the objective of boosting employment for two main reasons mentioned earlier 1) A number of these products are not actually produced in Senegal or involve minimal domestic value added. That is because the exports include re-exports—products imported into Senegal that are then transshipped to other countries in the region, notably the land-locked countries to the North of Senegal, with little domestic processing. 2) Some products are capital-intensive and thus not likely

to generate significant employment even if they do grow. Some products are both capital-intensive and re-exported.

If the import value of a product is greater than its export value there is a large possibility that Senegal acts merely as a middleman between this product's origin and its final destination. Table 2 provides some examples of goods that are likely re-exported at least in part. These re-exported sectors don't represent available domestic capabilities, contribute meaningfully to the complexity measure or provide potential for employment.

Refined petroleum is Senegal's largest export by far, constitution 14% of exports in 2015. Yet Senegal imports far more refined petroleum products than it exports, reflecting re-exports to other Sahelian West African countries, especially Mali. Senegal does have some domestic refineries but the large volume of imports suggests that the large positive RCA is misleading. Rice is produced domestically and exported but imports are far larger than exports. The exports of these products must reflect re-exports. In general, while the product space provides a start at ascertaining potential comparative advantage and prospects suitable for promoting in structural transformation, the list of sectors to be considered also requires judgment based on knowledge of the economy.

Furthermore, a surprisingly large number of products that Senegal exports are capital-intensive and not good prospects for raising employment of youth and women (Table 3). Senegal's largest export in value, refined petroleum is not only re-exported but is also very capital-intensive. Cement constitutes more than 6% of Senegalese exports but cement production is capital-intensive and employs few women. Other capital-intensive or natural resource intensive products such as gold, mineral products, and phosphoric acid create relatively few employment opportunities and provide little indication of the country's underlying capabilities.

Given the prevalence of re-exports, capital-intensive and natural-resource-intensive products in Senegal, the standard product-space calculation of distance is not very meaningful. Senegal is obviously a labor-abundant country with fairly limited natural resource endowments. The fact that many of its exports are capital and natural-resource intensive reflects the failure to develop globally competitive manufacturing and agricultural sectors, not intrinsic features of the economy. We therefore attempt to address export diversification and employment creation through a more visual and intuitive approach to the product space than those of other recent studies which rely on mechanical measures of distance and product complexity.

Table 1. Senegal's Largest Exports: Revealed Comparative Advantage (RCA), Export and Import Value (in Million US dollars) and Export Share (share of total exports in %)

	RCA	Export share	Exports	Imports	Net exports
Refined Petroleum	4.0	14.2%	390.4	787.2	-396.8
Gold	5.3	9.3%	255.3	0.9	254.5
Non-fillet Frozen Fish	69.0	8.3%	229.2	7.3	221.9
Cement	90.2	6.4%	176.8	6.1	170.7
Phosphoric Acid	212.1	6.4%	175.8	0.5	175.3
Soups and Broths	178.9	3.5%	97.6	8.1	89.5
Molluscs	33.3	2.6%	72.0	0.3	71.7
Calcium Phosphates	108.9	2.4%	66.9	0.0	66.9
Ground Nut Oil	934.1	2.3%	63.8	0.3	63.6
Ground Nuts	102.7	1.7%	45.8	0.0	45.8
Rolled Tobacco	11.0	1.6%	43.7	1.2	42.5
Titanium Ore	128.3	1.5%	40.8	0.0	40.8
Crustaceans	9.6	1.5%	40.5	0.1	40.4
Niobium, Tantalum, etc. Ores	188.4	1.5%	39.9	0.0	39.9
Fake Hair	50.5	1.4%	39.4	13.1	26.4
Non-fillet Fresh Fish	13.4	1.4%	38.9	0.1	38.8
Rice	9.4	1.4%	37.9	414.5	-376.6
Malt Extract	10.5	1.2%	33.5	117.1	-83.6
Raw Tobacco	14.7	1.2%	33.1	54.0	-20.9
Tropical Nuts (Cashews etc)	23.6	1.1%	30.5	0.8	29.7
Beauty Products	4.5	1.0%	28.3	12.2	16.1
Legumes	98.8	0.9%	25.1	0.1	25.1
Salt	48.2	0.9%	24.1	2.5	21.7
Fish Fillets	6.5	0.9%	23.6	0.1	23.6
Tomatoes	15.2	0.8%	23.3	0.6	22.7
Scrap Iron	4.6	0.8%	22.7	0.1	22.6
Tropical Fruits	12.0	0.8%	21.0	2.3	18.7
Scrap Copper	5.3	0.6%	17.5	0.0	17.5
Special Purpose Ships	3.1	0.6%	17.4	0.3	17.0
Melons	27.8	0.6%	16.3	0.0	16.3
Other Vegetables	6.9	0.6%	16.3	0.5	15.8
Processed Fish	5.6	0.5%	14.8	1.1	13.7
Raw Cotton	7.3	0.5%	14.4	1.5	12.9
Other Oily Seeds	18.6	0.5%	13.4	4.4	9.0

Source: MIT Atlas of Economic Complexity

Table 2. Products Where Senegal's Imports Exceed Exports, Likely Reflecting Re-exports, 2014 (Exports and Imports in Million US Dollars)

	RCA	Export share	Exports	Imports	Net exports
Refined Petroleum	4.0	14.2%	390.4	787.2	-396.8
Rice	9.4	1.4%	37.9	414.5	-376.6
Raw Iron Bars	4.3	0.4%	11.3	25.3	-14.0
Concentrated Milk	3.4	0.4%	11.1	47.3	-36.2
Plastic Lids	1.2	0.4%	10.4	34.5	-24.2
Palm Oil	1.9	0.3%	9.5	90.9	-81.3

Source: MIT Atlas

Table 3. Senegal Capital- or Natural Resource-Intensive Export Sectors (Exports in Million US Dollars)

	RCA	Export share	Exports
Refined Petroleum	4.0	14.2%	390.4
Gold	5.3	9.3%	255.3
Cement	90.2	6.4%	176.8
Phosphoric Acid	212.1	6.4%	175.8
Calcium Phosphates	108.9	2.4%	66.9
Titanium Ore	128.3	1.5%	40.8
Niobium, Tantalum, etc Ores	188.4	1.5%	39.9
Raw Iron Bars	4.3	0.4%	11.3
Mixed Mineral or Chemical Fertilizers	1.9	0.3%	8.1
Copper Wire	2.6	0.3%	7.7
Cold-Rolled Iron	2.87	0.3%	40.5

Source: MIT Atlas

Recently, Hausmann and his colleagues have adopted increasingly sophisticated methods of determining diversification opportunities using algorithms to find those products that do not currently display comparative advantage (RCA < 1), referred to as "Non-RCA products" but are both "close" to currently exported products and more complex than existing exports (Hausmann & Chauvin, 2015; Hausmann, Cunningham, Matovu, Osire & Wyett, 2014). The method is illustrated in Figure 13 for Senegal with a scatter plot of all 4-digit HS products non-RCA products (over 1000 products) with the product complexity (PCI) on the vertical axis and Senegal's "distance" to that product on the horizontal axis. The products deemed most promising are those in the upper left quadrant, i.e., those with PCI above the median for Senegal's Non-RCA products and those with below-median closeness to Senegal's RCA products (those with lower distance). The idea is to find products that would raise the complexity of Senegal's exports and at the same time are more feasible to produce as evidenced by their lower distance. To further narrow the

feasible range of products under consideration, it is possible to eliminate those products for which world trade is growing more slowly than average and those with low "opportunity gain". The opportunity gain index quantifies the contribution of a new non-RCA product in terms of its connectedness to more complex products. Intuitively, this means that the capabilities embedded in this product are proximate to the required capabilities of a number of other more complex products. This is similar to distance but takes into consideration product complexity as well.

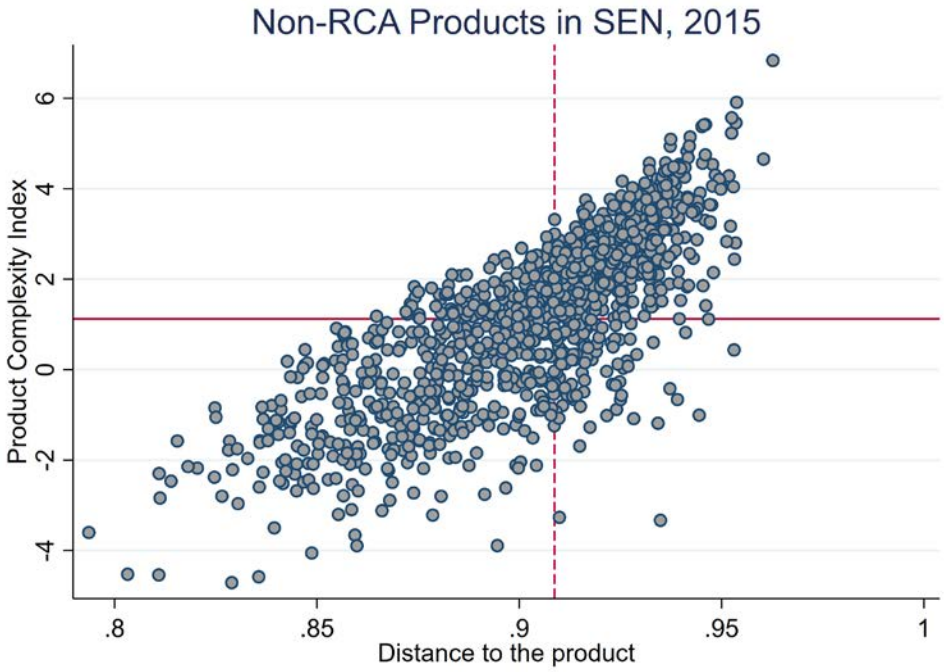
While this methodology is quite ingenious and may work well for countries with relatively advanced economies and diversified exports, we have come to the conclusion that such a mechanical procedure for identifying export opportunities is not practical or sensible for low-income countries like Senegal because the product-space concept of distance is likely to be misleading. Figure 14 illustrates the reasons why. It shows both Senegal's RCA and non-RCA products in 2015 in a scatterplot of PCI and distance as for Figure 13. In addition, the magnitude of exports for each product are displayed by the size of the bubble, with bubbles colored in blue being RCA products and those in grey non-RCA products[6]. The five largest of Senegal's 2015 exports are labelled in Figure 14, consisting of Refined Petroleum, Gold, Phosphoric Acid, Cement and Fish. Together these five products account for about half of Senegal's exports. Thus, "closeness" to these five products will strongly influence the distance variable for Senegal. The underlying premise of the product space methodology is that actual exports reflect capabilities and products which are less "distant" from existing exports are thus more feasible. These five products, however, would not provide a very good measure of capabilities for reasons noted above. First of all, several of them reflect natural resource endowments: gold, phosphoric acid (based on phosphate mining) and fish. While it could be argued that fishing involves skills and is very labor-intensive, extractive industries in general are capital- and natural resource-intensive and thus do not reflect the human and technological capabilities of the Senegalese workforce. Cement and petroleum refining are also very capital intensive and thus unlikely to meaningfully indicate paths to labor-intensive exports. Second, petroleum refining, like a number of other Senegalese exports, is in fact imported in much greater volumes than exports, and thus may largely be re-exported rather than produced domestically. While Senegal does indeed refine some petroleum products, the fact that imports are much larger than exports is hardly suggestive of comparative advantage.

[6] Grey bubbles can be quite large, reflecting sizeable exports for Senegal yet have RCA<1, i.e., Senegal's exports of that product, while fairly large, are below average as a ratio of world exports.

It is therefore highly questionable whether the measures of distance as calculated using the Hausmann & Chauvin (2015) and Hausmann, Cunningham, Matovu, Osire & Wyett (2014) method is meaningful for Senegal.

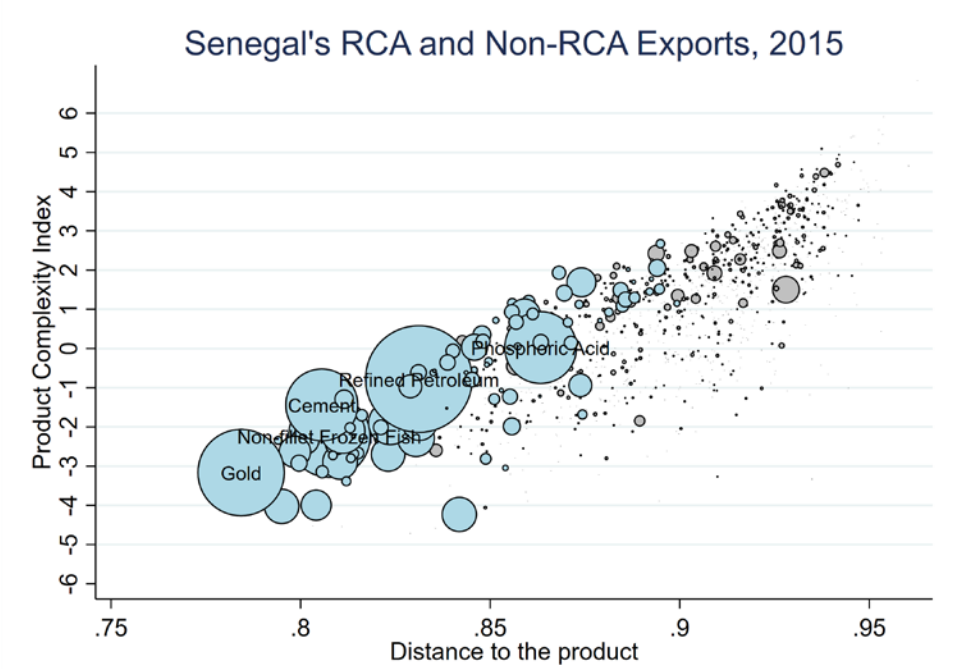
Furthermore, the "frontier" products" generated using the Hausmann & Chauvin (2015) method lack plausibility and coherence, both for agricultural products and manufacturing. Figures 15 and 16 show the non-RCA products for manufacturing and agriculture respectively identified by the Hausmann & Chauvin 2015 method. Table 4 displays the non-RCA sectors with the highest average of PCI, density (inverse of distance) and opportunity gain. The sectors identified in this manner lack any clear economic logic or intuitive appeal. There are a number of metal and machinery sectors identified, which makes little sense for a very low-income income like Senegal. Agriculture is a more plausible avenue for export diversification but many the agricultural sectors identified with the Hausmann & Chauvin (2015) method are also of dubious feasibility for Senegal. The highest ranked agricultural category in Table 4 is pigs, which makes no sense at all since Senegal is an overwhelmingly Muslim country and very few if any pigs are raised there. In addition, many of the other agricultural products that are identified are animal products requiring refrigerated transport, which is lacking in Senegal.

Figure 13



Source: Authors's calculation from MIT Atlas of Economic Complexity.

Figure 14



Source: Authors's calculation from MIT Atlas of Economic Complexity.

Figure 15

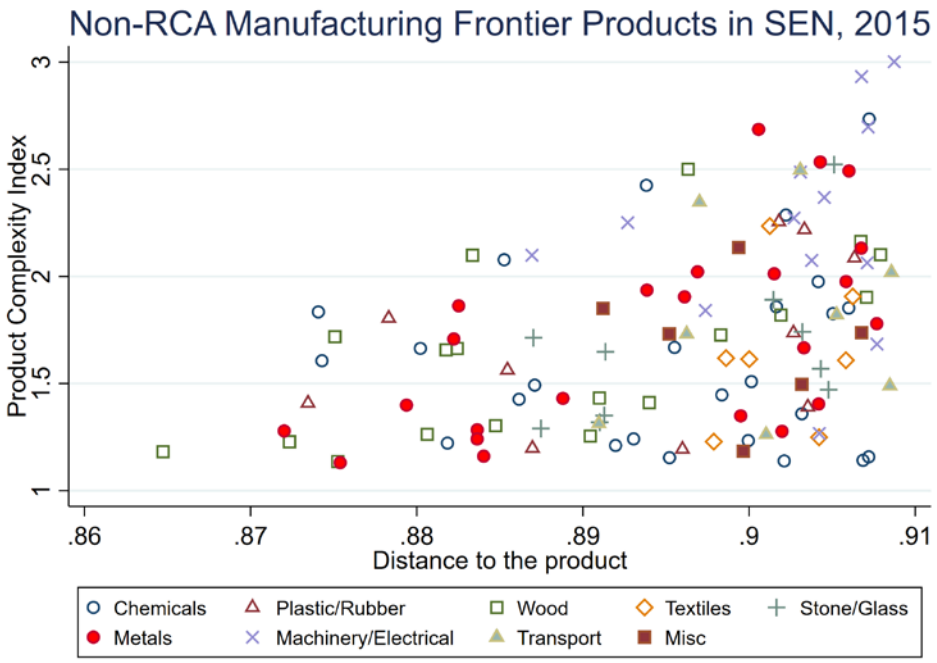


Figure 16

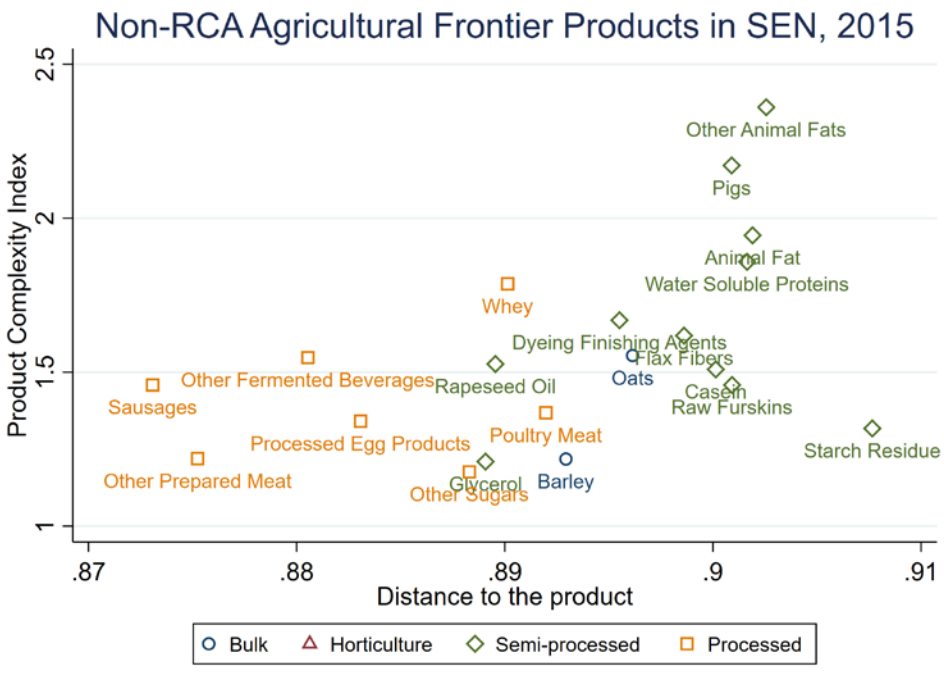


Table 4. Non-RCA Sectors with the Highest Composite PCI, Opportunity Gain and Density

	PCI	Opp. Gain	Density	Composite
Packaged Medicaments	2.90	1.18	1.17	1.75
Cellulose Fibers Paper	2.83	1.25	1.16	1.75
Other Iron Products	2.83	1.14	1.16	1.71
Newspapers	2.56	1.08	1.16	1.60
Nonaqueous Paints	2.46	1.12	1.18	1.59
Electrical Insulators	2.43	1.00	1.16	1.53
Other Printed Material	2.33	1.06	1.18	1.52
Recreational Boats	2.37	1.01	1.17	1.51
Trailers	2.36	0.96	1.17	1.50
Explosive Ammunition	2.33	0.92	1.16	1.47
Other Aluminium Products	2.29	0.95	1.17	1.47
Insulating Glass	2.34	0.87	1.17	1.46
Refractory Cements	2.12	1.05	1.16	1.44
Particle Board	2.32	0.82	1.18	1.44
Iron Powder	2.23	0.92	1.17	1.44
Large Aluminium Containers	2.09	1.06	1.17	1.44
Aluminium Pipe Fittings	2.15	0.92	1.16	1.41
Soil Preparation Machinery	2.12	0.93	1.17	1.41
Rubber Belting	2.09	0.88	1.18	1.38
Utility Meters	2.09	0.86	1.17	1.37
Other Cast Iron Products	2.07	0.85	1.18	1.37
Raw Plastic Sheeting	2.02	0.90	1.18	1.37
Plastic Building Materials	2.08	0.81	1.19	1.36
Glaziers Putty	1.99	0.90	1.18	1.35
Steam Boilers	2.01	0.82	1.16	1.33
Aluminium Pipes	1.89	0.92	1.17	1.33
Boiler Plants	2.08	0.71	1.16	1.32
Shaving Products	1.85	0.91	1.17	1.31
Other Plastic Sheetings	1.88	0.87	1.19	1.31
Stone Processing Machines	1.93	0.82	1.17	1.31
Pyrophoric Alloys	1.81	0.92	1.17	1.30
Safes	1.99	0.73	1.17	1.29
Aluminium Cans	1.87	0.79	1.19	1.29
Bandages	1.81	0.83	1.18	1.28
Pigs	1.94	0.73	1.16	1.28

Source: Authors' calculations based on MIT Atlas data.

We also should keep in mind that some products that are not currently exported may also have promise. In some cases, these may be "close" to existing exports; for example, production of fruit and vegetable juices are a natural progression from raw fruit cultivation. The product space analysis can help uncover some such "emerging champions". In other cases, though, labor-intensive products that are only produced at a very low level and not picked up by the product space could perhaps thrive if the business climate were improved. The textile-apparel sector is a case in point of such a "marginal" product, as discussed in our previous work (Golub and Mbaye 2002; Golub, Ceglowski, Mbaye and Prasad 2018).

6.3 Discerning Sectors with Potential for Boosting Employment

Instead of the Hausman and Chauvin (2015) approach we therefore revert to an alternative implementation of the product space concepts to determine promising sectors for export diversification and employment creation, adopted at the World Bank, e.g. for Ghana (Chandra and Osorio-Rodarte 2007) and Benin (World Bank 2009, Chapter 3). This approach is simpler and involves a more intituitive and visual approach to the product space. We begin by allocating industries into four categories: classics, emerging champions, disappearances, and marginal exports. Classics are products that have been exported with a significant RCA and volume for extended period of time. The majority of Senegal's classics possess low complexity indexes but provide substantial employment opportunities. For most of its economic history, a few classics—peanut oil, fishing and phosphates—occupied an overwhelmingly large share of Senegalese exports; recently, however they became less dominant not so much because other sectors have emerged as their own severe problems (Golub and Mbaye 2002). Emerging champions include export products that only recently gained a significant RCA and are showing promise for further growth. Although they have significant potential, their share is typically quite small. In Senegal's case, emerging champions represent attractive opportunities in terms of both employment and wealth-enhancing increase in complexity. A few emerging champions are too capital-intensive to create the desired employment opportunities for youth and women but have other benefits for the economy. Our goal is to examine the effects that an increase of share of emerging champions exports would have in the economy and determine what constraints these industries face. Disappearances are products whose RCAs decreased significantly over time. In regard to these products we must consider why Senegal lost its comparative advantage in them and whether or not

it would be possible and useful to revive these industries. Marginal exports include export industries in which Senegal never developed a strong comparative advantage. In some of these products, Senegal has a potential to eventually establish a comparative advantage, however, in others Senegal is not likely to become competitive. Our goal is to determine which ones of these industries are compatible with the Senegalese economic structure and identify the obstacles that so far have prevented Senegal from obtaining a comparative advantage in these areas. The textile/apparel industry is the most important of these, given the seeming potential advantages that Senegal has in this sector (Golub and Mbaye 2002). The resulting list of sectors are shown in Table 5.

In the remainder of this section we comment briefly on some of these sectors. We focus mostly on classics and emerging champions. We ignore disappearances as these do not have much potential.

Table 5 Senegalese classics, emerging champions, disappearances, and marginal exports.

	Products	Estimated PCI	Estimated RCA
Classics	Fish and seafood	-1.5	28.3
	Groundnuts	-2.0	26.5
	Peanut oil	-1.9	678.0
	Phosphates and Chemicals	0.0	3.7
Emerging Champions	Food Preparations	-3.9	187.0
	Hides and Leather	-1.8	30.9
	Horticulture	-1.7	7.0
	Tobacco products	50.5	31.8
	Synthetic Hair	-2.4	71.2
	Gold	-2.3	6.8
	Salt	-1.1	40.0
	Cement	-1.1	83.2
Disappearances	Cocoa beans	-2.9	0.0
	Tea	-2.1	4.4
	Coffee	-1.9	0.0
Marginal exports	Cotton	-2.4	8.5
	Textiles, Apparel	-0.8	128.7

Source: MIT Atlas

6.4 Classics

Table 6 lists the three main "classics"—longstanding and substantial exports—fishing, groundnuts, and phosphates. For each product, the main current exports are shown in the second column. The third column shows possible diversification avenues. The goods listed in bold are those that emerge from product-space links. The others are ones that strike us as plausible but are not revealed by the product space network.

Table 6. Diversification Options for Classics

Sector	Main existing exports	Export share	Diversification opportunities
Fish and seafood	Frozen Fish, Molluscs, Fresh Fish, Crustaceans, Fish Fillets	15.4%	**Fish oil**, **Netting**, **Pepper, Salt, Foliage, Animal pellets, Other Inedible animal products**, Canned fish
Groundnut Products	Peanut oil, groundnut meal, ground nuts	2.0%	**Rice, Tea, Raw cotton, (Locust beans, Seaweed, Sugar Beet, Cane),** Peanut butter
Chemicals	Phosphates and fertilizers	6.2%	**Vegetable residues, whey, sunflower seeds,** Generic drugs

Source: MIT Atlas and author's analysis.
Note: Industries in bold are from the product space, others based on logical plausibility.

Fishing

We can see that Senegal's product space is well connected in the area that represents the fishing industry (Figure 17). Senegal has a large RCA in many fish and seafood products.

Figure 17 Fishing in Senegal's Product Space is Well Connected

Source: MIT Atlas

Fishing has only a few primary connections to other goods in which Senegal doesn't already have a comparative advantage. They include netting, live fish (secondary connection), pepper, and a few others. Dealing with the serious problems confronting existing fishing sectors is probably more promising than pursuing these connected sectors., as will be discussed in the section 7 below.

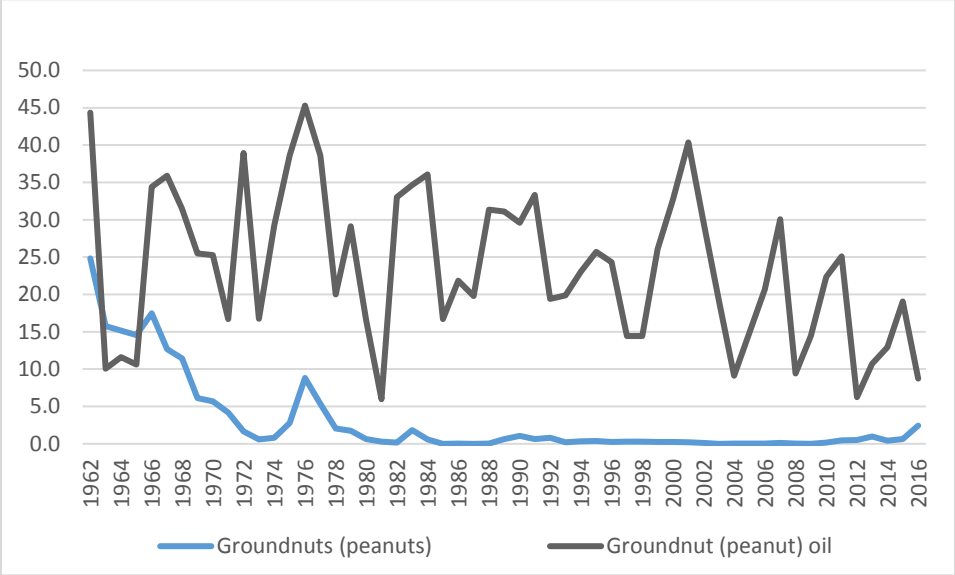
Groundnut products

Senegal has historically been one of the world's top producer of groundnut oil and groundnut meal. Groundnut oil is often thought of as Senegal's signature product. From 1960 to 1980, peanut oil alone constituted 20-30% of exports. The value of peanut oil exports during the 1960s ranged between 40 and 50 million US dollars, which is approximately equal to the present export value. In the late 1970s, peanut oil export value jumped to almost 200 million dollars making this product the pillar of Senegalese economy. Sluggish economic growth during the next 20 years revealed the limits of peanut oil as a basis for Senegal's economy. In the 1980s and 1990s,

the export value of peanut oil sharply fluctuated between 40 and 110 million dollars. Unstable market prices and susceptibility to unstable weather destabilized this sector exposing the need to diversify away from peanut oil (Golub and Mbaye 2002, Mbaye 2005).

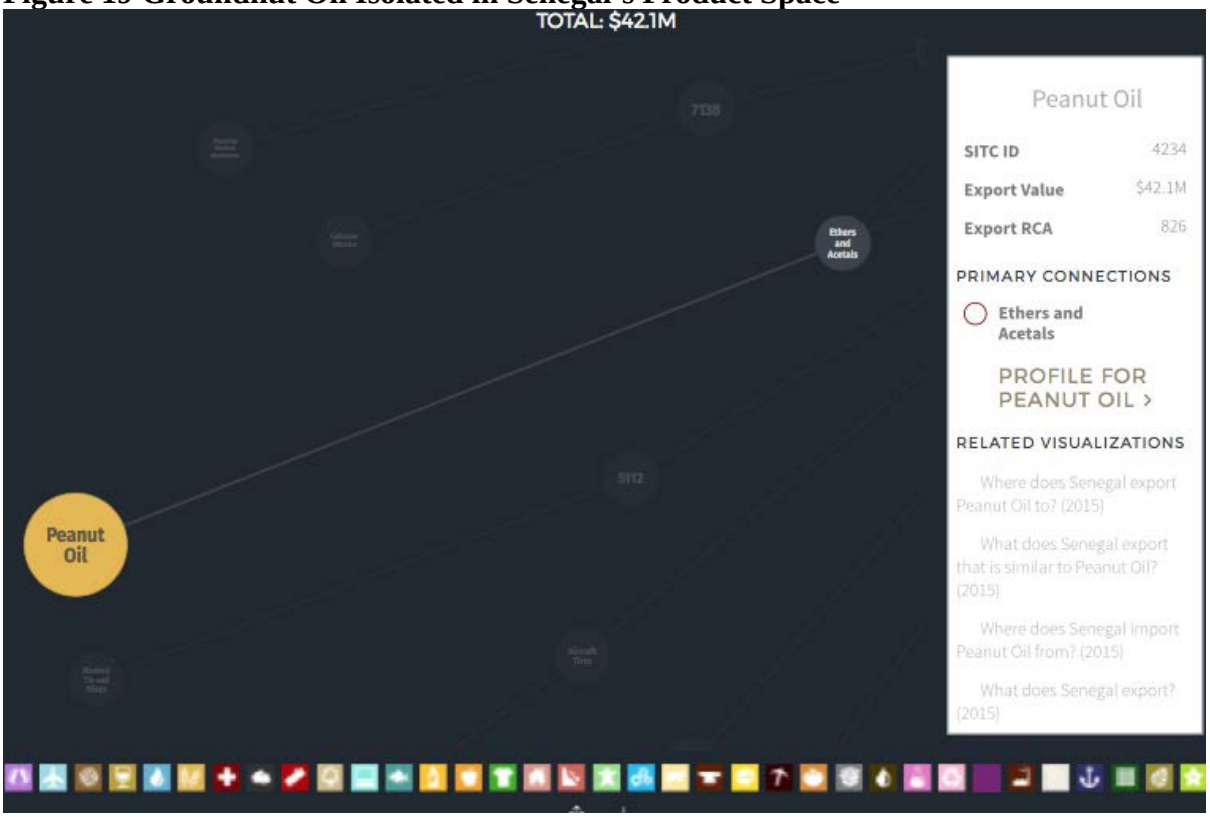
Figure 18 shows Senegal's share of the world market in groundnuts and groundnut oil. Senegal's very large but highly variable share of the world market is apparent. This share shows a downward trend in the last decade, however. Exports of unprocessed groundnuts, on the other hand, dropped to almost nothing after 1970 from a large global share in the 1960s.

Figure 18. Senegal's Share of World Exports of Groundnuts and Groundnut Oil (%)



Source: Authors' calculations from UN Comtrade data.

Figure 19 Groundnut Oil Isolated in Senegal's Product Space



Groundnut meal is a natural byproduct of peanut oil production, mainly utilized as a livestock feed. The aggregate value of world exports of groundnut meal also has decreased significantly since 1995.

Oddly groundnut oil, groundnut meal and raw groundnuts are not connected in the product space—they are each in very different locations with no nodes in common (Figure 19). This observation casts some doubt on the relevance of the product space data for this product for Senegal.

Phosphates and other chemicals

Originated in 1940s, chemical production played an important role in Senegalese economic growth. Senegal has vast reserves of extremely high-quality phosphate rock that can be used to obtain phosphoric acid - Senegal's main chemical export. Phosphoric acid is often used to produce phosphate salts for fertilizers and dental cements. Phosphate production provides some opportunities for income-enhancing diversification but doesn't seem to create employment for

women and youth. Phosphate ore is buried 30-40 meters deep underground and the mining process requires sophisticated machinery and little labor. Production of phosphoric acid itself is also capital-intensive. Phosphates offer a number of income-enhancing diversification avenues including fertilizers, dental products, and other chemicals but, these sectors provide few employment opportunities in general, and even fewer for women. Connected industries do not seem particularly promising for growth and employment creation either.

6.5 Emerging Champions

Table 7, analogously to Table 6, shows newly emerging industries, i.e., ones which only recently have displayed strong comparative advantage. We briefly discuss here and will pursue the most important ones in more detail in section 7.

Table 7 Emerging Champion Sectors

Sector	Main existing exports	Export share	Diversification opportunities
Hides	Sheep, goat, equine, and bovine hides (tanned and untanned)	1%	**Gold, Sheep and goats, other nuts, paper labels,** Leather apparel and accessories
Agro-Processing	Nuts, Tomatoes, Legumes, Melons, Tropical Fruit, Cereal Flours, Wheat Flours, Cassava, Frozen Vegetables	6.7%	**soap, cement, bran, packing bags, non-knit undergarments, cocoa beans, basketwork, fruit juice, plastic sheeting, bananas, cabbages, live plants, cucumbers, dried vegetables, grapes, flavored water,** Food manufacturing
Tobacco products	Rolled and processed tobacco	3.5%	**Baked goods, Flavored water, paper containers, concentrated milk**

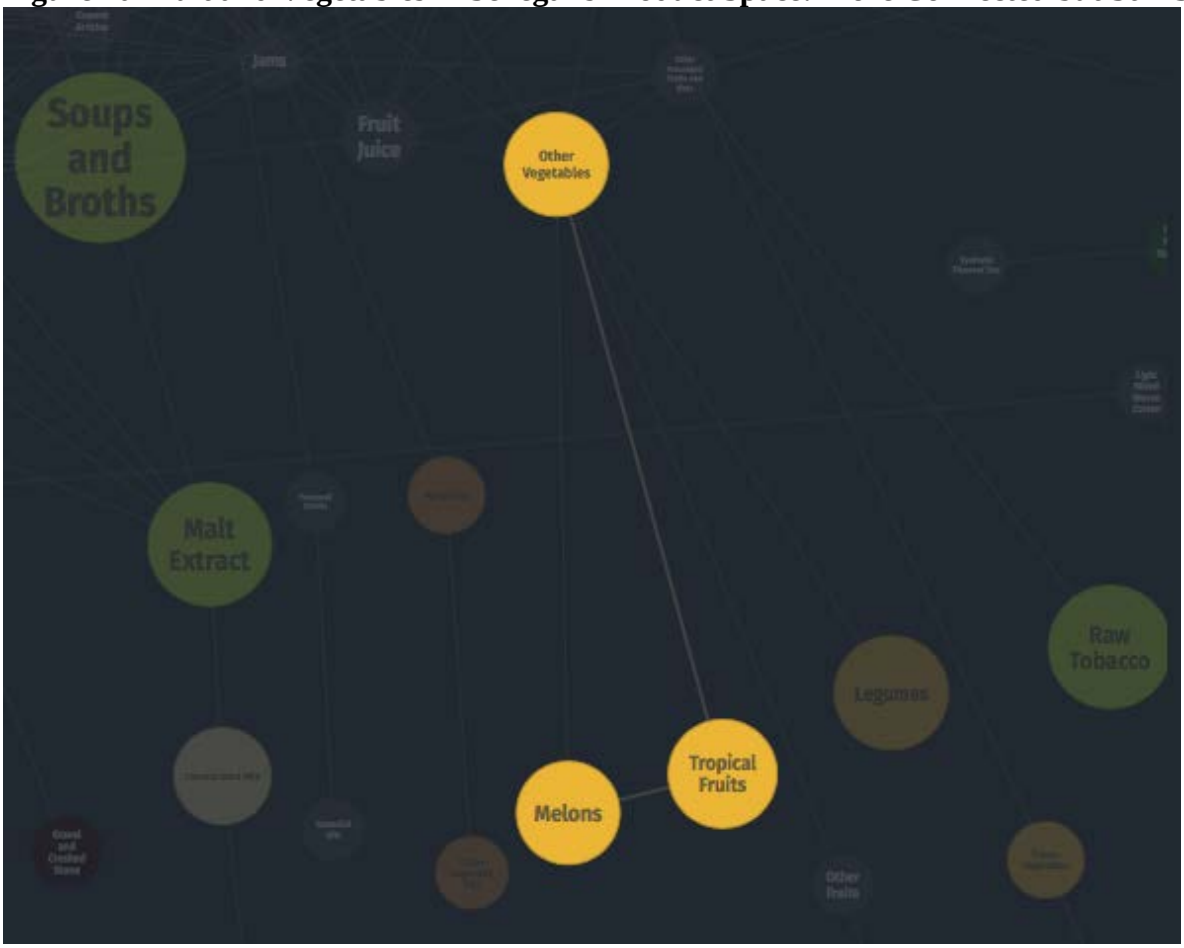
Source: MIT Atlas and authors' analysis
Note: Industries in bold are from the product space, others based on logical plausibility.

Horticulture and Food Products

Senegal has an outstanding potential to develop a strong fresh fruit and vegetable exporting sector but despite gradual progress exports remain small (English 2016). Figure 20 shows that

Senegal produces a number of products connected to vegetables and tropical fruit but in low quantities and some notable nodes such as fruit juice are empty.

Figure 20 Fruit and Vegetables in Senegal's Product Space: More Connected but Still Small



Expanding further from the traditional cotton and groundnuts to more high-yield horticultural crops will accelerate the growth of Senegalese economy. The country can rely on its good reputation as an exporter of high-quality produce to establish trade partnerships for the new sorts of fruit and vegetables that Senegal might diversify into. Some of the most promising diversification products include onions, potatoes, bananas, and mangoes. The atlas also indicates legumes, melons, tomatoes (UN, 2010).

Hides

Sheep are the most common livestock in Senegal. While their meat is usually consumed domestically, hides have made their way to the international market. In the recent years, RCA of sheep hides has increased dramatically making this product one of the most potent emerging

champions. While PCI of hides is rather low, this industry has a potential to create employment for women and youth. Labor is required at all stages of hides production, especially for processing and tanning which tends to primarily employ women.

Other Emerging Champions

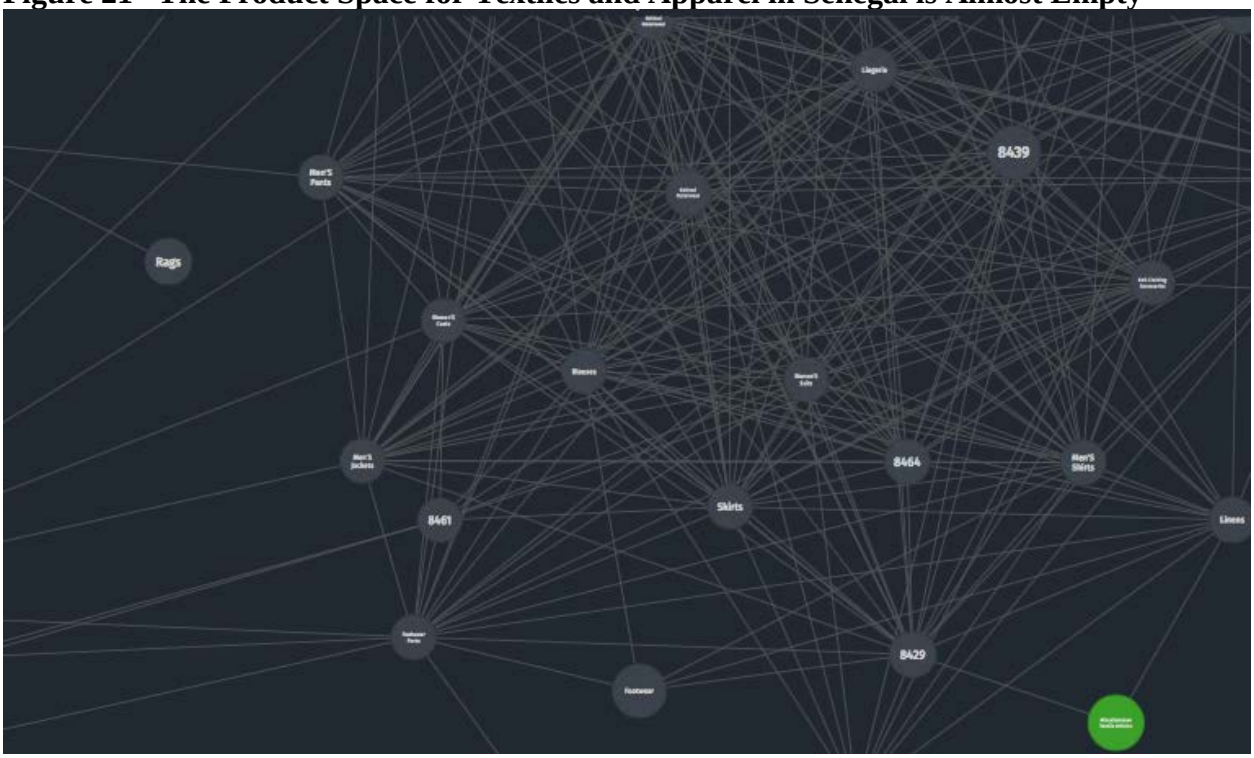
Some of the remaining emerging champions have the potential to accelerate growth of Senegalese economy and contribute to accumulation of resources that could be used to strengthen infrastructure. However, many of these sectors are capital-intensive and their development is unlikely to result in significant reduction of female and youth unemployment. Among the most prominent ones are tobacco industries that involve importing raw tobacco and exporting rolled cigarettes, gold mining, other mining and cement production. Mining is usually capital-intensive but there may be some exceptions that we will investigate. Salt and fake hair are likely labor-intensive and employ women. Senegal has become the largest salt producer in west Africa with about one third of total output being produced by small-scale harvesters[7]. The fake hair industry could be part of an expansion of fashion-related items.

6.6 An important Marginal: Textiles and Apparel

The textile and clothing sectors have been the starting point for industrialization in many countries over the last 200 years. As wages in China increase, opportunities for new exporters are improving. However, a number of emerging Asian economies such as Bangladesh and Cambodia are rapidly expanding market share and have further opportunities to do so. However, the product space for textiles is completely dark except for a small green dot for Miscellaneous textile articles at the bottom (Figure 21). But given Senegal's advantages in the sector and rising cost in Asia, this industry is worth further investigation.

[7] Source: The Guardian, Senegal looks to the salt of the earth. 29 March 2013
https://www.theguardian.com/global-development/gallery/2013/mar/29/senegal-salt-earth-in-pictures

Figure 21 The Product Space for Textiles and Apparel in Senegal is Almost Empty



Source: MIT Atlas.

7 Results of Field Research

We conducted interviews and conducted literature searches in several sectors identified by the product space analysis in the previous section. The authors have previously investigated these sectors and we use of our prior knowledge, other recent literature and interviews.

7.1 Fishing

The region's favorable natural conditions provided Senegal with some of the richest fishing grounds in the world. Fishing accounts for about 15% of Senegal's exports. Fishing's share of total exports sharply declined since the late 1990s when fishing occupied almost half of all exports. Sharp differences between yearly export values reveal the susceptibility of the industry to external factors such as weather conditions, depletion of fishing stocks, unstable fish prices, and foreign competition.

The fishing industry plays a central socio-economic role in Senegal. Being highly labor-intensive, it generates a significant share of employment opportunities for the population (Golub and Mbaye 2002, Mbaye 2002). These jobs include fish processing and distribution that primarily employs women. In addition, fish is the main source of protein for the Senegalese population.

In the last 20 years, the fishing industry has been facing an array of challenges created by overfishing, foreign competition, climate change, and dysfunctional local institutions. According to the UN, more than half of the fisheries around West Africa are dangerously depleted.[8] Local fishermen believe that foreign industrial boats are responsible for overfishing mackerel and grouper, the two local favorites, and destroying the marine habitat. Most scandals related to foreign overfishing involve industrial boats from China, Russia, and a few European countries.[9] However, it is clear that inadequate enforcement of local regulations also contributes to overfishing and drives up prices of increasingly rare bigger fish on the local market. Outdated technology and lack of information about timing and zones of reproduction result in unsustainable fishing practices and deterioration of fish stocks, as in cases when fishermen catch pregnant fish (Golub and Mbaye 2002). Increased pollution endangers not only the fish population, but also compliance with

[8] Source: VOA News. Overfishing leaves the industry in crisis in Senegal. 7 June 2017 https://www.voanews.com/a/overfishing-leaves-industry-crisis-senegal/3891172.html

[9] Source: Reuters. FEATURE-All at sea: foreign fishing fleet drains West African waters. 8 May 2017 http://www.reuters.com/article/africa-fish-overfishing/feature-all-at-sea-foreign-fishing-fleets-drain-west-african-waters-idUSL8N1I43AH

European health standards, which is crucial to get access to export markets. Lack of access to long-term credit, shortage of qualified managers, and poor infrastructure for artisanal fishing all present serious challenges for the industry.

In recent decades, fishing stocks and catches have trended downwards, adversely affecting fishers' incomes and food security for the population. Two main factors are responsible: anthropogenic and climatic. The anthropogenic causes include, among others, the pressures on habitats and marine ecosystems (estuaries, deltas, mangroves), industrial pollution at sea (disposal of liquid and solid waste, offshore mining and oil wells) and overfishing. The climatic factors involve the warming of the oceans leading to fish movements, loss of marine biodiversity and decline of coral reefs (GIEC 2014). Climate change is particularly threatening to coastal regions where the economy revolves around fishing.

A salient aspect of the fishing industry is the separation into industrial and artisanal components. Within industrial fishing there is a further cleavage between nationally-owned and foreign-owned boats and processing facilities. Fish stocks in Senegal can be separated into four categories: coastal bottom, coastal surface, deep-sea bottom, deep-sea surface (mainly tuna).

The problems of the industrial and artisanal sectors are quite different, although there are some issues of overlapping interest. There is much mutual suspicion between these two branches of the industry.

Artisanal and industrial fishing compete to varying degrees for many of these species. Artisanal fishing now dominates coastal surface fishing, which consists mainly of smaller fish such as sardines, which are not highly sought after in the export market, and are destined mostly for local consumption or other African countries. These fish are processed locally through a highly developed semi-formal or informal sector using traditional methods smoking, salting). Nearly all industrial fishing of sardines has ceased in the face of the competition from the artisanal sector.

The most intense competition revolves around 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. In recent years, however, Abidjan has increasingly been the preferred destination for tuna boats fishing near or in Senegalese waters.

Artisanal Fishing

Artisanal fishing in motorized pirogues is a modern extension of the long tradition of fishing in Senegal predating the colonial era. It is generally recognized that Senegalese fisherman are highly knowledgeable about their craft and courageous. Indeed, it is a dangerous profession, particularly around Saint Louis due to the rough seas and lack of a breakwater. Many fishermen lose their lives each every year (approximately 50 in the St. Louis area alone).

The fishing code reserves 6 nautical miles of the coastal zone for traditional fishing. In addition, the government exonerates all equipment purchases from taxes.

Artisanal account for about 80% of all captures and 60% of exports. It also involves extensive on-shore handling, processing and transporting, which are very labor-intensive. Nonetheless, there are many impediments to further progress. The problem of over-fishing discussed below for industrial fishing is also applicable to artisanal fishing, especially in the Petite Cote region South of Dakar.

Credit. Credit to artisanal fishing is a perennial problem with mutual recriminations from bankers, government, and borrowers. Creditors cite the poor record of repayment while debtors point to onerous conditions and the politicization of credit facilities.

There is a long history of failed government initiatives to provide credit to rural and informal producers, including fishing, with new loan programs started, arrears developing, followed by debt cancellations. These repeated debt cancellations have exacerbated the moral hazard problem by setting a precedent that credit need not be serviced.

The main extant government program is associated with the Caisse Nationale de Credit Agricole (CNSAS), created in 1984. The interest rates are viewed as too high by small fisherman. Also, the CNSAS requires substantial down payments that are difficult for small fisherman to comply with. The procedures involved in applying for a loan are long and arduous for a small business.

The share of non-performing CNCAS loans to the fishing sector is about 12.5%, high but not as bad as in agriculture. This high rate of delinquent loans reflects many of the characteristics of informal fishing: the precarious nature of this trade, lack of training and technical knowledge in modern management and accounting, high geographic mobility making tracking of debtors difficult, and the attitude among fisherman that credit need not be repaid. There is also the common perception that the CNCAS is not well managed.

Private financial markets have not been able to fill the void left by mostly unsuccessful government credit programs. The large commercial banks are not well adapted to making loans to small-scale fishing, and do not have the requisite technical expertise in the fishing industry that would enable them to screen and monitor risk accurately. Nor are artisanal fishermen in a position to provide the demanding documentation and collateral that banks normally require. The fishermen decry the lack of appropriate credit facilities, while creditors complain about the chronic lack of repayment of existing debts. Interestingly, the women who process the catch are reputed to be far more reliable in servicing their debts than the fishermen themselves.

There have been a number of initiatives to extend credit to artisan fisherman through lines of credit placed by donor organizations at the commercial banks. The main such line of credit is the Fond de Promotion Economique (FPE). The success of the FPE has been mixed at best. There have been several other lines of credit in recent years financed by other donors (Canadians, EU, French, World Bank), but the artisanal fishing industry has not benefited much. Networks of mutual credit associations may be the best solution to the financing problem of small fishing enterprises.

Infrastructure. Infrastructural problems tend to be more severe for the artisanal than the industrial fishing sector. While there has been considerable progress, infrastructure deficiencies remain in the areas of hygiene and cleanliness as well as other areas. There are deficiencies in the unloading, stocking, and processing of fresh fish: availability of ice and cold storage, water , electricity and cleanliness. In addition transportation of the product is a problem in some locations: Petite Cote, Sine Saloum, Casamance.

Safety issues. Fishing is a very dangerous profession. A number of measures should be taken to reduce the number of fatalities and loss of production such as encouraging fishermen to wear life jackets. A breakwater is badly needed in St. Louis.

Skills and Information. Although highly skilled in traditional tasks, artisanal fishing professionals lack knowledge about modern techniques and norms. Approximately 90% of artisanal fisherman are illiterate. Cultural attitudes may also sometimes be a problem. For example, fishermen have resisted wearing life vests despite their low cost and the substantial number of lives that could be saved. As another example, the women involved in marketing and processing of the catch suffer from lack of organizational and knowledge of modern techniques and export markets.

Industrial Fishing

The 1994 devaluation gave a strong boost to the fishing industry, but the boom seems to have mostly petered out. The increased fishing effort may have contributed to the depletion of stocks of some species. Agreements with other countries allow for foreign trawlers to operate in Senegal's exclusive economic zone. The most important of these is the agreement with the European Union.

Our interviews and documentary research uncovered the followed principal problems.

Overfishing. Almost everyone we talked to expressed concerns about overfishing of certain species. A decline in Senegalese fishing yields has been observed in recent years for trawling and to a lesser extent for pirogues. The declining catch combined with the creation of new processing firms following the devaluation has entailed problems of excess capacity at many industrial fish processing firms.

The most affected species seem to be coastal bottom fish such as soles, grouper, and daurade. For others such as shrimp, there is no firm evidence of over-fishing, but there is cause for concern given the increasing number of shrimp boats. Coastal surface fish (sardines) do not at present show convincing signs of over-fishing, but bear watching because of their importance for domestic consumption. Likewise, some species of tuna seem to be approaching a threshold of overexploitation.

A number of observers note, however, that there is substantial of uncertainty about the available estimates, and that more thorough research is needed. Moreover, too little is known about the timing and location of zones of reproduction. For example, fishermen catch pregnant female octopus, resulting in large reductions in reproduction, although some efforts have recently been made to return babies to the ocean. Most of the professionals we talked to expressed some alarm about the problems of overfishing, and stressed the urgency of obtaining more accurate information about the conditions of fish stocks and the sustainability of current fishing efforts.

There are also regulations about the volume of the catch and restrictions on fishing locations based on the size of boats. But implementation and enforcement are problematic. The industrial fishing organization GAIPES believes that there is substantial evasion of the regulations. All domestic and foreign industrial boats must have an official on board to ensure that these regulations are respected. Fishing professionals, however, are skeptical about the effectiveness of

these observers. Indeed, the observers are paid, lodged and fed by the operator of the vessel that they are observing, seemingly providing perverse incentives for reporting violations.

Another source of controversy concerns which groups of fishing fleets are most responsible for overfishing and disregard of restrictions. There is much mutual recrimination between small artisan fisherman and industrial fishing, each accusing the other of primary responsibility for overfishing. Among some industrial fisherman, also, there is suspicion that foreign boats take more fish than they are entitled to.

In addition to the problem of overfishing, increasing pollution is a potential threat to both the supplies of fish and norms of hygiene.

Access to Credit. Views are divided about the extent of this problem for the industrial fishing sector. For some firms, this appears to be a secondary issue. A number of owners feel that if an enterprise is well managed and has transparent and open accounts, banks will provide credit, and cite their own experiences to this effect. However, this credit is mostly short term and long-term credit is said to be difficult to get. While it is true that the fishing fleet is very old, our interviews revealed that a number of firms have substantially upgraded their boats, so that the common perception of an antiquated fleet is overdone.

International Norms of Hygiene. Another serious obstacle is the non-conformity to international norms of hygiene. This lack of hygiene is especially linked to the unloading by traditional fisherman on beaches, which are also used as garbage dumps.

The European Union in particular has demanding norms on hygiene. Recently, major investments were undertaken by Senegalese producers to upgrade their facilities to meet EU norms. The EU provided partial financing of these investments. This was a costly endeavor, with many firms unable to cope and going bankrupt, but has been largely completed successfully by the remaining exporting enterprises.

Labor Relations. Several firms were emphatic about the gravity of the conflicts with unions. The tuna-canning industry in particular has had repeated problems with unions. Workers in industrial fish processing are affiliated with the CNTS (Confederation Nationale des Travailleurs Senegalais), which had close ties with the formerly governing Socialist government. Thus, the strikes were often at least tacitly supported by the government (interview with U.S. embassy).

The GAIPES and others cite the high cost of handling at the port, associated with labor regulations protecting dockers, as one of the main reason that tuna boats tend to deliver their catch to Abidjan rather than Dakar, when they have a choice. The resistance of unions to improved productivity is more of a problem than their wage demands. The unions particularly target foreign ships and enterprises. There is sometimes violence and theft.

***Worker Skills and Training*.** While Senegal has many skilled traditional fishermen, there is a shortage of ship officers with the technical and managerial expertise required in industrial fishing. Thus, a number of boat operators use expatriates for middle management and technical posts at considerable additional expense. These expatriate workers earn much higher salaries than Senegalese workers. Clearly, there would be benefits both to firms and local workers to having trained Senegalese personnel who could carry out these tasks.

There exist several public institutes whose mandate is to train workers for these tasks. According to our interviews, these agencies are unable to carry out their functions, in part because of budget limitations.

Physical Infrastructure. For industrial fishing (as opposed to artisanal fishing), infrastructure is mostly adequate. Roads are of uneven quality, with affects mostly the artisanal fishing industry's ability to move its produce to factories in the Dakar area. Shipments of fresh fish by air, which require care in handling and timeliness, seem to have improved.

At the Port of Dakar, the main problem for the tuna boats evoked above seems to be labor relations rather than inadequate facilities.

Several firms complained about the power outages and the expense of purchasing generators. This contributes to the high cost of electricity in Senegal compared to other countries.

Corruption and the Judiciary. A pervasive problem in Senegal has been the politicization of business decisions, with government tilting the playing field towards larger firms and those with political connections. There are allegations ship capacity is systematically under-reported by many operators, to evade taxes and to obtain more leeway in coastal fishing zones.

7.2 Groundnuts and Groundnut Products

Peanuts have been Senegal's predominant cash crop since the colonial era, and Senegal is a major producer of groundnut oil. As in other African economies, in the first decades after independence, control of the cash crop switched from the colonial power to a government-operated

marketing board. In Senegal, the Office National de Coopération et d'Assistance au Développement *(ONCAD)* oversaw all stages of production and distribution in the first decades after independence, including providing inputs and credit to smallholder farmers, then purchasing, transporting, processing and marketing the output. Until the middle of the 1970s, groundnuts were the mainstay of the Senegalese economy: the sector's contribution to GDP was about 20%, and it accounted for more than 70% of employment and was by far the most important export commodity. Towards the end of the 1970s, however, a steady decline set in, in part due to declining rainfall and desertification. Poor management of the sector also played a major role (Golub and Mbaye 2002). Declining performance and the need for more competition led the government to gradually disengage from the sector, culminating in the privatization of SONACOS in 2005. Unfortunately, the reforms failed to improve the industry's performance: decline in use of fertilizers, distribution problems, tensions in access to credit and other basic services to producers etc. All this led to a dramatic decrease in production and exports.

Although the market was partially liberalized in the 1990s, until 2005 the government retained a near monopoly on the purchase and processing of groundnuts through the parastatal SONACOS, which produced peanut oil and oilcake, primarily for export. The SONACOS was heavily involved in the cultivation of the crop, extending credit, distributing seed and fertilizer to the peasants, and through its affiliate SONAGRAINES which collected the crop for the SONACOS factories. Farmers increasingly diverted their products to the parallel market. The SONACOS factories had old equipment and suffered from excess capacity (Golub and Mbaye 2002). The World Bank recommended that it be split up and sold to a couple of investors in order to promote competition and avoid the "too big to fail" syndrome. However, in 2005, after many delays, the SONACOS was privatized with the French firm SUNEOR taking over all its assets. Recently SUNEOR declared bankruptcy and was renationalized under its old name SONACAS. A number of smaller firms still operate in the vegetable oil market, notably NOVASEN.

SUNEOR was engaged in two separate product lines involving vegetable oils. First, it processed peanuts into peanut oil and a byproduct, oilcake for animal feed, both of which are exported, although to different markets. Second, it imported unrefined vegetable oils, particularly soy oil, which it refines and sells on the domestic market, given that these oils are much cheaper than peanut oil. SUNEOR had a refining capacity of 100,000 tons for imported vegetable oil.

The organization of the peanut value chain in Senegal is of critical importance for the economy and poverty alleviation but has proven very difficult to solve. As in other cash crop systems there is a fundamental tradeoff between competition and coordination, with regard to pricing, research and extension, provision of credit and inputs, collection of the crop and payment to farmers, as described by Poulton et al (2004) for the cotton industry. Smallholder farming requires organization and assistance from either large private firms or the state for input provision and quality control that is difficult to reconcile with decentralized competition. Under the previous state-operated marketing boards inputs were typically provided on credit, with the loans being repaid through a deduction from the purchase price at the time of collection. More recently, governments have tended to subsidize input purchases by producers. Clearly, opportunistic behavior by farmers as well as input providers is a potential serious threat to the viability of such an integrated system. Until 2005, as noted previously, the parastatal SONACOS played a dominant role. The quality of SONACOS's performance was controversial. Some claim that politicization and lack of efficiency characterized the SONACOS but former officers disagree. It was hoped that privatization would improve the situation. In principle a large multinational firm with expertise in peanut cultivation and distribution could do this effectively although regulation would still be necessary in the absence of competition. Such a firm has an incentive to assist farmers and pay a favorable price to obtain a high-quality crop, particularly if farmers can sell on the parallel market. However, the problems of disorganization and opportunistic behavior have continued due to difficulties of contract enforcement and monitoring, and the peanut industry remains in crisis.

One of the major problems confronting groundnut oil production has been obtaining an adequate supply of peanuts to crush into oil. Prices were set through negotiations of the stakeholders before the season, linked over time to world prices but in the short run stabilizing prices to producers. Thus, in some years producer prices exceeded world prices and in some years fell below. If market prices are set below world prices or rise after producer prices have been set, farmers and traders have a short-run incentive to sell on the parallel market rather than deliver to oil processors. In anticipation of this possibility of opportunistic behavior, oil processors or intermediaries may be reluctant to provide credit and inputs to farmers. Binding contracts and enforcement of agreements are crucial to limit the collective failure of the system. In 2011, the government liberalized the marketing and purchase of peanuts from farmers, breaking the

SUNEOR-NOVASEN control, thus providing more opportunities for competition and options for farmers but reducing the scope for sector-wide coordination. Chinese traders became particularly active and purchased at considerably higher prices than the oil processors. The prices were so favorable, in fact, that farmers often neglected to save some of their crop to use as seed in the following season.

A related longstanding problem involves provision of credit and debt repayment. In the current system, the OPS (Operateurs Privés Stockeurs) have been at the center of the difficulties. The OPS buy the peanuts from the peasants and resell to the oil producers namely SUNEOR. But the OPS have frequently either defaulted on their obligations to peasants (the "bons impayés") or paid low prices while also failing to deliver the crop to SUNEOR, preferring to sell to the Chinese traders who were allegedly importing into Vietnam without paying duties, a practice which has now been stopped. These conflicts involving financing translate into inadequate supply of inputs to farmers, resulting in lower yields, and the cycle of underperformance continues into the next season.[10]

Production of peanut oil varies due to fluctuations in the size of the peanut crop, as well as the magnitude of peanuts sold in unprocessed form. The latter increased sharply in 2012 as Chinese buyers entered the market following the 2011 liberalization and purchased at considerably higher prices than SUNEOR was offering, with peanut oil production declining accordingly. As seen above in Figure 14, exports or peanut oil have been much larger than exports of peanuts in raw form. Unprocessed peanut sales increased sharply in 2011 and 2012, while peanut oil exports collapsed in 2012, coinciding with the rising world prices of peanuts noted above, the liberalization of the market, and the entry of new purchasers, mainly Chinese traders.

Today, peanut oil export value continues to oscillate from year to year, due mainly to erratic domestic supply. Though peanut oil has the largest RCA among all Senegalese exports at 500-800 depending on the data set used, it currently constitutes less than 3% of the total export value. Nevertheless, Senegal remains the third largest exporter of peanut oil in the world. Does this mean that, with some reforms, the peanut oil industry has a potential to once again become the center of Senegalese economy? Should Senegal's government invest resources into this sector? Given the recent dynamic of peanut oil trade, it seems questionable. The growth of groundnut oil exports during the last couple of decades has been sluggish comparing to the increase in global trade in

[10] See: "Quand L'Arachide Sénégalaise Retrouve un Second Souffle," *Leral.net*, Novembre 25, 2012.

general and Senegal's peanut oil processing facilities have been operating at very low capacity utilization. Also, it is unclear if the poor management of the peanut oil sector can be reversed. The privatization of the parastatal SONACOS by SUNEOR did not yield the expected improvement and SUNEOR was recently renationalized, as noted above (World Bank 2015).

Groundnut meal is a natural byproduct of peanut oil production, mainly utilized as a livestock feed. The aggregate value of world exports of groundnut meal also has decreased significantly since 1995.

Surprisingly, edible (green) groundnuts are now a much more promising export than groundnut oil. High quality edible groundnuts can command much higher prices and therefore farmer incomes than groundnut oil. Until the 1970s, Senegal was a major exporter of green groundnuts with the export value of the industry over 40 million dollars. In late 1960s scientists discovered that, if stored improperly, peanuts may develop mold that contains aflatoxin - a poisonous substance known to cause cancer. Senegal, like many other developing countries, didn't have the technology and storage infrastructure to preserve the groundnuts which led to their contamination with aflatoxin. As a consequence, Senegalese raw groundnut exports experienced a sharp decline in the 1970s. The industry started its recovery in 2010 when Senegal began to export groundnuts to China. The current export value is approximately $14 million and, given the establishment of modern storage technologies and increased provision of credit, edible groundnuts have the potential to provide much needed employment and accelerate growth of the Senegalese economy (Mbaye 2005, World Bank 2017). Box 1 provides details on the issue of sanitary and phytosanitary issues for groundnuts and horticulture.

Box 1.

Sanitary and Phyto-Sanitary Standards and International Competitiveness in Senegal

For agricultural products, a crucial constraint on exports is the non-compliance with quality standards, including sanitary and phyto-sanitary standards (Mbaye, 2009). The Aflatoxin contamination in peanuts, and outsized levels of pesticide residues in fruits and vegetables are obstacles to exports of Senegal's agricultural products. Unsustainable cropping practices resulting from lack of training and information to producers remain common in Senegalese agriculture. According to available data in the horticultural sector in the suburban area of Dakar, only 27% of producers are aware of sustainable practices in horticultural production (Gueye, 2009).

Groundnuts

The groundnut subsector includes two major commodities: oil-mill groundnut (peanut oil and oilcake) and confectionary groundnut (CG). Groundnut crops are submitted to a process of selection, particularly a Hand Picking Selection (HPS), through which the share of output that meets certain criteria as regards size and level of aflatoxin contamination, is qualified CG and exported as such. The remainder (écarts de tri) is sent for trituration in oil mills.

Aflatoxin is secreted by a poisonous mushroom called Aspergillus Flavus. Some experiments done on animals conclude that it is cancer-producing. Moreover, empirical medical research shows that areas in which aflatoxin-contaminated products are most consumed are the ones in which liver cancer is the most prevalent.

Normally, aflatoxin is not contained in unrefined peanut oil, since the toxin completely disappears with trituration. However, aflatoxin does contaminate oilcake. This latter is mostly designed for animal consumption. It is proven that animals fed with contaminated oilcake can have their milk contaminated by a special form of aflatoxin called M1 aflatoxin, which is particularly dangerous for children. There are four different types of aflatoxin in peanut oilcake and CG: B1, B2, G1, and G2. The B1 type is deemed the most poisonous. To date, there is no technical way to completely eliminate aflatoxin in foodstuffs. In setting standards against aflatoxin contamination, the ALARA (As Low As Reasonably Achievable) principle is used.

Since the early 1980s, SONACOS has developed a technical process using ammonia that reduces aflatoxin contamination in peanut oilcake to 10 ppb, far below the 20 ppb accepted in Europe. In contrast, Senegalese exports of CG are considerably hampered by product grade and level of contamination. Due to the poor quality of seeds used as CG, Senegalese products have problems meeting some basic standards.

Aflatoxin develops under certain conditions of temperature and humidity, which are all characteristic of CG production areas in Senegal. To avoid contamination, peasants have to adopt certain good practices during the production process in the field. Research shows that a production process following good practices in CG cultivation results in a final product that has an acceptable low contamination rate, with a very high probability. Furthermore, these good practices in the field are the only way to control contamination. While managing quality to reduce aflatoxin contamination is within the capacity of Senegalese farmers, lack of incentives is making good agricultural practices very difficult to implement.

The reasons for the dramatic decline in CG exports are twofold. First, peasants are not rewarded for quality management. Normally, the price of higher quality nuts is superior to the prices of the others; but for very long time, farmers have not gotten appropriate seeds for CG. Hence, whatever effort they devote to managing quality during the production process are not likely to result in a product that meets international CG standards, especially as regards size. Second, agricultural activity is very risky in Senegal due to high dependence on rainfall. If a drought occurs (which is quite common), farmers have problems servicing their debts.

Fruits and Vegetables

In Senegal, a study supervised by the Senegalese Agricultural Research Institute (ISRA) and another study of Ceres Locustox (CLX) on the issue of pesticide residues on horticultural products in the *Niayes* revealed significant discrepancies between MRLs (Maximum Residue Limit) tolerated and actual levels of residues of chemical pesticides found in vegetables grown in the Dakar urban periphery (*Les Niayes*).

The study of CERES Locustox (2008) revealed the presence of five organophosphorus pesticides and 8 organochlorine pesticides on vegetables in the market. Among these they cited pesticides such as dieldrin, DDT (dichlorodiphenyltrichloroethane), aldrin, heptachlor, which are on the list of "the banned twelve" of the Stockholm Convention on Persistent Organic Pollutants (POPs). Other commonly used pesticides in locust control have also been found on samples analyzing vegetables: ethyl chlorpyrifos, malathion and fenitrothion.

In order to address the SPS challenges facing horticultural exports, beyond mitigating the uncontrolled use of pesticides, an appropriate policy of packaging of goods is also needed. Products are in general sent abroad without proper packaging; which further deteriorates their quality. Given the highly perishable character of these products, we also need a system of storage at the airport level to make sure they are not damaged. Such a facility was set up in Dakar airport in 2012, but its limited capacity makes it unsuitable for the booming horticultural exports.

While these adjustments are needed on the supply side of fruit and vegetable exports, efforts are also needed on the demand side. Most importing countries set their SPS standards at very high levels, difficult to meet by exporting developing countries. Hence, instead of protecting consumers against health hazards, SPS standards are in fact acting as non-tariff barriers. Both sets of countries need to abide by the WTO rules to balance consumer protection and enabling export flows from developing to developed countries.

7.3 Horticulture

Geographical location relatively close to both Europe and America, access to seaports, and a favorable climate to grow produce all year around equips Senegal with everything it needs to meet the increasing demand for organic fruit and vegetables on western markets. After the CFA Franc devaluation in 1994, horticultural production exhibited a substantial improvement (UNCTAD 2010). However, the increasing necessity of GlobalGap certification and the difficulties of satisfying its demanding quality norms have restricted growth of the sector in the early 2000s (Golub and McManus 2008; Mbaye et Gueye 2015). The increased administrative barriers to entry to the international market in horticulture lead to the domination of larger companies in the sector; the share of small rural farmers dropped from 23 to 10% between 2000 and 2007. While many small farm owners were unable to withstand the competition of bigger companies, consolidation led to reduction of poverty among landless workers who now had more opportunities to find employment at the large international conglomerates.

The devaluation of the CFA franc and the liberalization of agricultural markets in the mid-1990s stimulated Senegalese horticulture and set it on a path of rapid growth in quantity and in quality that continues today. Although fruit and vegetable production (FFV) production remains only a fraction of total agricultural output, the sector is expanding even as traditional crop production falls. It is dominated by three crops: green beans, cherry tomatoes, and mangoes, and the comparatively high yields per hectare on these products are encouraging farmers to increasingly substitute away from groundnuts and cotton and into horticulture. An advertising campaign by several MNCs promoting a high-quality reputation of Senegalese FFV exports, called ‘Origine Sénégal’, has also been widely successful and enabled exporters to obtain a premium on their products, thereby creating an incentive for additional investment in FFV.

A number of substantial, though not insurmountable, constraints impede expansion of the sector. Supply-side obstacles are centered about 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. Demand-side constraints are also a problem, which include stiff international competition (especially from Morocco and Egypt) and adherence to quality standards. However, recent R&D provides viable solutions to many of these issues: the apparent potential for the expansion of production beyond the Niayes into vast, uncultivated regions would alleviate the strain on land and water, the persistent exploitation of off-season marketing would bypass much of the international competition, and the progress of exporter associations such as ONAPES have already helped and would continue to help many companies obtain EurepGAP certification. Furthermore, the possibility for diversification into potatoes and onions and the growing feasability of food processing and packaging also suggest a promising future for Senegalese horticulture.

Moreover, the welfare implications of horticulture production for export in Senegal have been recently assessed (Maertens, et al, 2007), and the results are strongly positive. This outcome is surprising in light of the rapid consolidation of the FFV sector into a few multinational firms that do not source produce from outgrowers (namely GDS, Sepam, Solial Vert, Baniang, Safina, and Agriconcept), a trend that is due to more rigid quality standards, requirements of traceability, and consequently a powerful incentive to vertically integrate. The study finds that in spite of this consolidation, and indeed because of it, the returns on horticulture production are more equitably distributed, more widespread, and more effective in reducing the incidence of poverty. In this way, the Senegalese government and international donor agencies have an obvious role in establishing an attractive environment for FDI by way of upgrading the physical infrastructure, improving financial markets, and increasing the availability of skilled labor. The primary obstacle to effective, active support, then, is not the lack of clear goals, but rather the convoluted structure of and interactions between existing aid agencies in Senegal.

The absence of coordination between public and private organizations may be the foremost binding constraint to the development of horticulture in West Africa. This fragmentation is especially critical in Senegal, where the number of alphabet agencies (mostly international) rivals that of Ghana. This is in part due to the presence of several Islamic development institutions that generally do not coordinate with other agencies. It is also in part due to the relative lack of

governmental support to FFV, although some recent attempts have been made by the Ministry of Agriculture to improve dialogue between organizations. Perhaps most significantly, there is simply no dominant or sufficiently authoritative external organization or private trade association, like USAID and UFEA in Uganda, to effectively funnel aid and target project needs. The majority of aid (about 75%) is currently invested in 'hard' infrastructure, with a large share of the remainder being directed toward encouraging environmentally sustainable production techniques. Yet while these are certainly important needs, redundancy and incompatible objectives oftentimes renders such intervention unproductive.

Senegal should consider both exporting to neighboring African countries as well as growing organic produce for European markets. However, improvements in infrastructure and business climate are needed for Senegal's horticulture to improve international competitiveness. Lack of access to credit and difficulties related to obtaining required international certifications, along with arid climate and a poor national transportation network are among the greatest challenges facing Senegalese horticulture. Development of wind energy, drip irrigation, and better roads are essential for success of this sector. Better processing equipment and cold storage are needed to allow Senegal to diversify further into frozen and processed vegetables, which could be another profitable opportunity. FDI and foreign buyers play a critical role in the distribution of horticultural products, so it is essential to improve the general market environment to attract more foreign investment. Finally, the government and international donor organizations must work together to promote the effectiveness of the above investments and control the environmental impact of the sector.

7.4 Textiles and Clothing

Global buyer chains dominate the apparel industry, with much labor-intensive manufacturing and assembly shifting to developing countries. A highly sophisticated international division of labor has developed, with the most unskilled, labor-intensive operations moving to developing countries with very low wages. As local firms acquire greater experience and technological and managerial capabilities, and wages rise, these countries lose the most labor-intensive operations and upgrade to more sophisticated products. Through this process, apparel production for export has spread to Asia, Latin America and North Africa, beginning with the most labor-intensive products, and then gradually shifting to more complex skill-intensive products.

Except for Mauritius, however, Sub-Saharan Africa has hardly participated in this globalization of manufacturing and of apparel in particular. Certainly, Senegal has not.

This is at first surprising since Senegal would seem to have a comparative advantage in textiles and clothing given its lack of natural resources, favorable geographical location and abundance of informal skilled tailors. Senegal inherited a rather developed textile sector from the colonial era. Until the 1990s, Senegal produced at all stages of the vertical chain, from raw cotton to finished clothing. Senegal had much greater formal production and employment in the more capital-intensive textile sub-sectors (spinning, weaving, printing) than in labor-intensive apparel assembly. Virtually all large scale apparel production in Senegal ceased in the 1980s. By the early 2000s, the sector was near collapse (Golub and Mbaye 2002). The latter study revealed the textile industry's pervasive inefficiency and lack of capital investment, resulting in obsolete equipment and poor management. 15 years later, the situation is even more dire and almost all the firms we interviewed in 2002 are gone except for one small clothing distributor, Laay Diaara. Even Laay Diarra has largely ceased production and now imports clothing from Turkey.

The demise of the industry occurred despite ent provision of seemingly generous investment and export incentives in the establishment of one of the first export-processing zones (EPZ) in Africa in Dakar in 1974. The 1994 devaluation had a short-run positive effect on this sector, but mostly for the relatively capital-intensive sub-sectors (weaving and spinning) rather than the labor-intensive apparel sub-sector. Golub and Mbaye (2002) chronicle the departure of Coultex, a Moroccan-French firm that set up in the EPZ in 1998, after less than a year of operation, illustrating the weaknesses in the Senegalese business climate, and the failure to attract or retain internationally footloose firms. Box 2 discusses the failure of the Dakar EPZ.[11]

[11] Box 2 draws on Golub et al (2018).

Box 2:
The Failure of the Dakar Export-Processing Zone: Comparison with Mauritius's Success

The Dakar EPZ was created in 1974, one of the earliest in the world. It has almost completely failed to achieve its objectives of boosting employment through foreign investment (Madani, 1999). Much like its competitors, the zone offered exemptions from taxes on corporate income, customs duties, and taxes on machinery, along with unrestricted repatriation of capital and profits. However, employment in the Dakar EPZ reached a high of only 1200 in 1986 and declined further to 600 in 1990. The project was finally aborted in 1999 when it hosted only 14 active enterprises with a total of 940 employees. Its failure to spark employment growth reflected major deficiencies in the overall business environment, especially labor market rigidities, high utility and transportation costs, and cumbersome bureaucratic procedure. The EPZ failed to insulate firms from these economy-wide problems.

The comparison to Mauritius is instructive. The EPZ programs in Senegal and Mauritius were in some ways quite similar. They were established three years apart in the 1970s and offered similar tax incentives. The countries also have some social, geographical and political similarities. Both are very small but have favorable coastal locations for accessing developed country markets and long-standing cultural and economic ties to other regions of the world. Both benefited from trade preferences in developed countries and were not constrained by the Multi-Fiber Accord (MFA) restricting textile exports. They are both among the few countries that have maintained democratic elections and ethnic harmony since their independence in the 1960s. Yet the outcomes could not have been more different. Mauritius experienced major foreign investment inflows, diversification of industry, rising incomes and employment generation, whereas Senegal fared poorly in all these regards both within the EPZ and in the national economy.

Mosley (2018), Frankel (2012), Bheenick and Shapiro (1991), among others, identify several economic and political characteristics that were crucial to the Mauritian success: 1) Tax revenue from sugar exports was used to finance EPZ development and increased social spending, particularly on education, raising domestic labor productivity and easing social tensions; 2) The foreign exchange value of the Mauritian remained consistently competitive; 3) Relatively well developed infrastructure 4) Domestic wage rates were kept low to promote labor-intensive industry, partially accomplished by exempting EPZs from labor legislation. There is less agreement on the role import barriers played. Most importantly, as Bheenick and Shapiro (1991, p.267) put it: "Above all the government must be persistent, flexible, responsive and realistic. An unwieldy and unprofessional bureaucracy, disdainful of market incentives, and concerned only with limited political considerations, would almost certainly have led to failure."

In contrast, economic and social policies have been much less favorable in Senegal. Senegal suffered from a prolonged period of currency overvaluation in Senegal following independence, eventually ended by a massive 50% devaluation in 1994 (Cissé, Choi, & Maurel, 2017). Infrastructure investment and

education lagged in Senegal. There were also major policy differences that significantly impacted the development of domestic industry. Mauritius's oversight was flexible and pragmatic; in Senegal's EPZ, domestic exporting firms were prohibited from entering the zone and instead faced higher taxation, further increasing the anti-export bias of import-protection measures (Farole, 2011; Cissé, Choi, & Maurel, 2017). More generally, firms in Senegal complained that the promised incentives were delivered late if at all and they were not in practice exempt from Senegal's highly restrictive labor laws.

At bottom, the institutional environment and political commitment in Mauritius was much better than in Senegal. While far from perfect, Mauritius featured a better business environment overall, an approach that has led to its description of "one big EPZ" (Madani, 1999). On the other hand, Senegal's poor infrastructure, failure to deliver incentives in a timely way, and inability to insulate firms from onerous labor-market regulations and union agitation undermined both the zone and the single-firm free trade points (Farole, 2010). Overall, the Mauritian government did what it took to make the EPZ a success whereas Senegal was largely stymied by powerful interest groups engaged in rent-seeking. The deeper reasons for these institutional differences are beyond the scope of this paper.

The clothing industry now consists of a booming informal sector composed of independent tailors working on their own or in small shops. Their number is not known, but it probably now substantially exceeds 12,000, the estimated number in 1976 (Golub and Mbaye 2002). These tailors are often highly skilled. Their craft has been passed down from father to son for generations. There are currently a few small-scale producers of apparel employing at most two hundred workers in all.

Clothing for the Senegalese population is provided by imports, legal and illegal. An increasingly large component consists of imported used clothes from developed countries ("*friperie*") providing very cheap clothing for the poor (now estimated to be more than half the population).

Reforms similar to those required for improvements in groundnuts, fishing and horticulture are even more essential to develop a viable clothing industry. High formal sector wages and stringent labor-market regulations in Senegal are additional concerns of particular importance for clothing producers (Golub, Mbaye and Chwe 2015; Golub, Ceglowski, Mbaye and Prasad 2018).

Our interviews revealed are several other problems that deter an expansion of formal-sector clothing production and exports, similar to those in the fishing industry: inadequate training and technical assistance, lack of access to finance, and in some cases administrative hassles, unreliable

and slow judiciary proceedings, and conflicts with unions. The latter problems are likely to increase in severity as a firm becomes larger and more "formal", thus deterring the transition to the formal sector. The high cost and unreliable supply of electricity is also a problem confronting small producers, for whom the cost of purchasing a generator is very burdensome. Any hope of developing a competitive textile-clothing sector will depend on far-reaching improvements in the business climate to make it hospitable to global value chains in this intensely competitive sector.

8 Conclusions

Despite favorable political and geographic circumstances and numerous ambitious reform plans, Senegal's economic performance has been disappointing. Senegal has made progress in opening to trade and despite some recent improvements, remains near the bottom in indicators of the business climate. Per capita GDP is roughly the same as at the time of independence in the early 1960s. Furthermore, what limited growth has occurred is often in capital-intensive sectors. Thus, as in many other Sub-Saharan African countries, lack of employment opportunities, especially for youth and women, is a pressing development problem. About 90% of employment is in the informal sector, in agriculture and increasingly in urban areas in the form of street traders and other petty services with very low incomes, minimal benefits and no security. As a result, poverty remains elevated. It is clear that Senegal needs stronger growth but also more labor-intensive growth. Recently, there have been some signs of improvement, with growth rising in the last few years and tentative emergence of some new sectors with employment-generating potential but hardly enough to make a dent in pervasive underemployment.

Historical experience reveals the importance of growing and diversifying exports in boosting income and employment. Successful emerging economies include Mauritius and Botswana in Sub-Saharan Africa; Chile and Mexico in Latin America; and Bangladesh, China, Malaysia and Vietnam in Asia and Southeast Asia. In all these instances, labor-intensive exports played a leading role in long-term growth, sparking a cycle of investment, innovation, and poverty reduction. We have used the product space and previous analyses of Senegal's economy to ascertain possibilities for export growth that could play a key role in raising employment.

The product space is a representation of country's pattern of comparative advantage and can be visualized in a graph with nodes that represent existing exports and a tool to identify potential avenues of export diversification that are "close" to current exports. Products closeness is determined by the extent to which other countries with similar exports produce that good. The product space analysis also enables computation of the "economic complexity" of currently exported goods. Product complexity refers to technological sophistication. The presumption is that countries grow by mastering increasingly complex products. In practice, complexity is measured indirectly by assessing the extent to which a good is produced by high-income countries. Thus, the product space can reveal which products are both "close" to and more "complex" than

currently-exported goods and thus can be used to identify possible diversification opportunities that will spur growth.

While the product-space methodology is ingenious and useful as a starting point, we argue that it should be used with caution and supplemented with institutional and historical knowledge of an economy, especially for a low-income economy such as Senegal. There are two particularly significant limitations of the product space approach. First, there may be a negative relationship between a product's complexity and its labor-intensity. Since employment generation is a crucial element of development, labor-intensity may be more important product complexity. For this reason, we exclude capital-intensive products such as petroleum refining and chemical products from the focus of this paper even though they are a large part of current Senegalese exports. Second, the product space is built around the concept of reveled comparative advantage (RCA) that is based on the extent to which a country exports a product in a greater proportion to its total exports than the rest of the world in aggregate. However, RCA can sometimes be misleading if examined in isolation from imports. A country can have a high RCA while simultaneously having a trade deficit in that product. In Africa especially, sometimes countries re-export goods they imported from abroad with minimal value added. The product space approach fails to distinguish between domestically produced goods and re-exports. Thus, while the product-space methodology provides a useful framework and information about potential export diversification opportunities, it is important to be aware of its limitations and to supplement it with in-depth knowledge of the economy in question.

We adopt an eclectic approach to identifying export sectors with potential for boosting employment and growth using both the product pace and detailed knowledge on the history and current functioning of the Senegalese economy, based on our own prior research and that of others. Drawing on some earlier implementations of the product-space approach, we classify potential exports into three categories: classics, emerging champions, and marginals. Classics are goods that have long been and continue to be exported. In the case of Senegal, the most important of these are groundnuts/groundnut products, fish/fish products and phosphates/chemicals. We largely exclude phosphates and chemicals from the analysis. Emerging champions are goods which have recently witnessed rising exports. We focus in particularly on horticulture (fruits and vegetables) where Senegal has recently experienced rising exports. Marginals are goods which at one point may have been significant but have declined or failed to take off. A notable marginal

for Senegal which we examine is textiles/clothing. Clothing in particular is a quintessential labor-intensive export which has served as the starting point for industrial development in countries around the world, and in which Senegal has seeming potential but has floundered.

Fishing. Senegal has some of the richest fishing grounds in the world and fishing accounts for about 15% of Senegal's exports. The fishing industry plays a central socio-economic role in Senegal and generates a large number of jobs in fishing as well as fish processing and distribution that primarily employ women. In the last 20 years, the fishing industry's natural advantages have been undermined by overfishing, foreign competition, climate change, and dysfunctional local institutions. The overfishing problem interacting with climate change is leading to reduced catches and threatens the very survival of the sector. The government, the artisanal and the industrial fishing sectors must work together to confront their shared problems: monitoring and regulation of fish stocks, technical assistance, infrastructure and finance. Infrastructure has improved but severe deficiencies remain at the level of roads, electricity availability, and unloading and processing facilities for artisanal fishing. Weaknesses in social capital, notably the capricious and inefficient judicial system and confrontational labor relations remain very important in hampering the competitiveness of the industrial fishing sector as well as other industries. The often-evoked financing problems would be alleviated if these other problems of physical and social infrastructure, appropriate regulation, and technical assistance are addressed. While the government has a clear role in aiding artisanal fishing, it must strive to maintain a level playing field and avoid special assistance to well-connected firms.

Groundnuts and groundnut oil. Groundnuts have been Senegal's signature product and dominant export since the colonial era until recently. In the early years of national independence the groundnut industry was badly mismanaged by the government. Over the last three decades the industry has been substantially liberalized but performance has remained dismal. The main privatized groundnut oil producer SUNEOR has gone bankrupt after struggling for years and the sector has been renationalized. An underlying problem is that Senegal has a strong comparative advantage in groundnuts but is less competitive in peanut oil. This lack of competitiveness in peanut oil is not necessarily intrinsic as it reflects general weaknesses in the business climate noted in the case of fishing. In any case, green (unprocessed) groundnuts can be much more lucrative than peanut oil if they are of high quality and can meet demanding sanitary and phyto-sanitary norms in European markets. Unfortunately, Senegal's green groundnuts have been barred from

foreign markets because of contamination with aflatoxin, a cancer-causing mold that grows on peanuts when they are not stored, processed and transported under proper climate-controlled conditions. The aflatoxin is solvable with investments in infrastructure and adaptation of better technologies. The lack of effective government support agencies and incentives for farmers has stymied progress. A concerted effort by government, foreign investors and peasant associations is required but has yet to materialize.

Horticulture. Favorable geographical location and climate to grow produce all year underpin Senegal's significant potential to boost fruit and vegetable exports to Europe. Opening of the sector to foreign investment has played a salutary role. As for groundnuts, however, stringent quality norms in Europe are a major impediment. The scarcities of skilled labor, arable land, water, basic infrastructure, extension and other public services, and credit are also serious impediments. Lack of coordination between donors, the government and the private sector is a problem. So are the general weaknesses in the business environment noted for fishing.

Clothing and Textiles. Clothing and textiles have been the stepping stone to industrial development since the industrial revolution and global value chains have brought developing countries into the process over the last 50 years in a dramatic fashion. Senegal has a number of natural and historical advantages in this industry: a favorable location for export, political stability, lack of natural resources and hence no "resource curse", a relatively well-developed formal industry inherited from the colonial era and a tradition of skilled informal tailors. Yet the formal textile and clothing sector almost entirely collapsed in the face of foreign competition in the 1990s and has never recovered. Senegal's formal clothing industry was supported by high import barriers and the industry could not compete in the face of smuggling and the liberalization of the 1980s. More tellingly, unlike many other developing countries, Senegal has been unable to attract investment and outsourcing from global retailing chains. The root of the problem is the dysfunctional investment climate: deficient infrastructure, particularly electric power outages and poor port functioning, burdensome labor market regulations, and lack of organized training facilities and thus weak human capital make Senegal unattractive to foreign investors in competitive, footloose industries. Seemingly generous investment incentives are insufficient to offset the other weaknesses. The comparison of export processing zones (EPZs) in Senegal and Mauritius is particularly revealing. Mauritius's EPZ thrived while Senegal's failed to take off despite a number of similarities between the two. The fundamental reason is that in Mauritius the

government had the independence and flexibility to implement an effective EPZ whereas in Senegal firms in the EPZ were not insulated from the general deficiencies in the business climate.

In summary, despite strong comparative advantage in each of these sectors, and substantial opportunities to upgrade and diversify *within* them, we find that they all face daunting yet remediable constraints in the institutional environment. It is pointless to seek to diversify the economy in new industries until these fundamental obstacles are addressed. The most important are lack of investment and maintenance of basic infrastructure, corruption, administrative inefficiencies, and excessive labor market regulations.

References

Aiginger K. (2001). Europe's position in quality compétition, entreprise papers, N° 4.

ANSD (2016). "Enquete Nationale sur L'Emploi au Senegal 2015."

Benjamin, N. C. and A. A. Mbaye (2012). *The Informal Sector in Francophone Africa* (Washington DC: World Bank).

Bheenick, R., & M. Schapiro (1991). The Mauritian Export Processing Zone. *Public Administration and Development, 11*, 263-267.

Boone, C. (1989). *Merchant Capital and the Roots of State Power in Senegal*, 1930-1985, (New York: Cambridge University Press).

Chandra, V. and I. Osorio-Rodarte (2007). "Options for Export Diversification and Faster Growth in Ghana" Chapter 5 of *Ghana Country Economic Memorandum*, World Bank.

Cissé I., S. Tall (2001). "Impact du système de production horticole sur l'environnement des Niayes"; CRDI.

Cissé, F., Choi, J. E., & Maurel, M. (2017). Industrial Policy in Senegal. In C. Newman, J. Page, J. Rand, A. Shimeles, M. Soderbom, & F. Tarp (Eds.), *Manufacturing Transformation: Comparative Studies of Industrial Development in Africa and Emerging Asia* (pp. 136-154). Oxford: Oxford University Press.

Cissé, F., J. E. Choi and M. Maurel (2014). "Scoping Paper on Industry in Senegal," *WIDER Working Paper* 2014/57.

English, P. (2016). "Senegal: A Service Economy in Need of an Export Boost", draft.

FAO (1966). Proceedings of Fao Symposiumon Integreted pest control, Organisation des Nations Unies pour l'Alimentation et l'agriculture 11-15 octobre 1965 Rome,

Farole, T. (2010). *Second Best? Investment Climate and Performance in Africa's Special Economic Zones.* The World Bank, International Trade Department. The World Bank.

Fondation Ceres Locustox (2008). Le panier de la ménagère.

Frankel, J. (2012). *Mauritius: African Success Story.* Harvard University, Center for International Development, Cambridge.

Geller, S. (1995). *Senegal: An African Nation Between Islam and the West*. (Westview: Boulder).

GIEC (2014). 5ème rapport du GIEC sur les changements climatiques et leurs évolutions futures. Impact, adaptation et vulnérabilité. URL: http://leclimatchange.fr/.

Golub, S. S. and A. A. Mbaye (2002). "Obstacles and opportunities for Senegal's International Competitiveness: Case Studies of the Peanut Oil, Fishing and Textile Industries," *World Bank Working Paper*.

Golub, S. S. and A. A. Mbaye (2009). "National Trade Policies and Smuggling in Africa: The Case of The Gambia and Senegal," (with Aly Mbaye), *World Development*.

Golub, S. S., S. A. O'Connell and W. Du (2008). "Export Competitiveness and Development in LDCs: Policies, Issues, and Priorities for Least Developed Countries," report prepared for UNCTAD.

Golub, S. S. and Jeffery McManus (2009). "Export Horticulture and African Development," report prepared for UNCTAD.

Golub, S. S., A. Bernhardt and M. Liu (2011). "Development and Trade Strategies for Least Developed Countries," paper prepared for UNCTAD.

Golub, S. S., A. A. Mbaye and H. Chwe (2015). "Labor Market Regulations in Sub-Saharan Africa with a Focus on Senegal," University of Cape Town Development Policy Research Unit *Development Policy Research Unit Working Paper*.

Golub S. S. and F. Hayat (2015). "Employment, Unemployment and Underemployment in Africa *Handbook of Africa and Economics*, edited by Justin Lin and Celestin Monga, 2015.

Golub, S.S., J. Ceglowski, A. A. Mbaye and V. Prasad (2018). "Can Africa Compete with China in Manufacturing?" *The World Economy*.

Golub, S.S., A.A. Mbaye, L. Chen, F. Gueye, J. L. T. Garza (2018). Demand- and supply-side constraints to employment creation in Africa, with Case Studies of Benin, Burkina Faso, Ethiopia, Ghana and Senegal, Paper prepared for the African Development Bank.

Gueye A. (2009). Que savons-nous de la qualité des aliments que nous consommons ? Etude de cas des systèmes d'exploitation horticoles périurbaines des Niayes, Mémoire de DEA, PTCI, Centre de Recherche d'Economie Appliquée (CRAE).

Hausmann, R. & Chauvin, J. (2015). Moving to the adjacent possible: Discovering paths for export diversification in Rwanda. *CID Working Paper No. 294*. Cambridge, MA: Centre for International Development at Harvard University.

Hausmann, R. & Hidalgo, C. (2011). The network structure of economic output. *Journal of Economic Growth*, 16(4), pp. 309–342.

Hausmann, R. & Klinger, B. (2007). The structure of the product space and the evolution of comparative advantage. *CID Working Paper No. 128*, Harvard University.

Hausmann, R., Cunningham, B., Matovu, J., Osire, R. & Wyett, K. (2014). How should Uganda grow? *CID Working Paper No. 275*. Cambridge, MA: Center for International Development at Harvard University.

Hausmann, R., Hidalgo, C. et al (2011). Atlas of Economic Complexity: Mapping Paths to Prosperity.

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

IMF (2017). "Senegal: Selected Issues," *IMF Country Report* 17/2.

Madani, D. (1999). *A Review of the Role and Impact of Export Processing Zones.* Development Research Group. The World Bank.

Mbaye, A.A. (2002). An Industry Level Analysis of Manufacturing Productivity in Senegal. Africa Region Working Paper Series No. 41 November 2002

Mbaye A.A. (2009). "Sanitary and Phytosanitary Standards and African Country Agro-food Exports: An Assessment of the Senegalese Groundnut Subsector". The African Integration Review, vol.3 n°1, January 2009.

Mbaye, A.A. and Adama Gueye. (2014). SPS standards and international competitiveness in Africa: thec ase of Senegal Connecting to global markets Challenges and opportunities: case studies presented by WTO chair-holdersillenium Challenge Account (MCC) (2017). "Senegal Constraints Analysis Report."

Mbaye, A.A. and S. S. Golub (2003). "Unit Labor Costs, International Competitiveness, and Exports: The Case of Senegal," *Journal of African Economies*, No. 2, 2003.

Mbaye, A.A. (2005). "Sanitary and Phytosanitary Requirements and Developing Country Agro Food Exports: An Assessment of the Senegalese Groundnut Sector". *World Bank Agriculture and Rural Development Discussion Paper*.

Mbaye, A.A., P. English and S. S. Golub (2015). "Protection, Employment and Poverty Reduction in Senegal: The Sugar, Edible Oil and Wheat Industries," (with Aly Mbaye), *World Bank Working Paper*.

Mosley, P. (2018). Why Has Export Diversification Been So Hard to Achieve in Africa? *The World Economy, 41*(4), 1025-1044.

Ministère de la Jeunesse, de l'Emploi et de la Promotion des Valeurs Civiques (2014). "L'Emploi des Jeunes au Sénégal : une Priorité Nationale ».

Terrell, K. and J. Svejnar (1990). *How Industry-Labor Relations and Government Policies Affect Senegal's Economic Performance*, (Washington DC: World Bank).

UNCTAD (2010). *Assessment of Progress and Lessons for the Fourth United Nations Conference on LDCs (LDC-IV) and Beyond.*

World Bank (2009). "Diversification and Innovation Opportunities in Benin," *Benin Country Economic Memorandum* (Chapter 3).

World Bank (2015). "Etude Diagnostique de la Chaine de Valeurs Arachide au Sénéßgal," Report No. ACS16609.

World Bank (2017). "Senegal Groundnut Value Chain Competitiveness and Prospects for Development," Agriculture Global Practice – West Africa.

Appendix

Table A1: All Products in Senegal's Product Space (2014), HS Classification

Category	Product	PCI	Export Value	Share of Exports	Import Value	RCA
Animal and Vegetable Bi-Products	Ground Nut Oil	-1.94	41.5	1.40%	1.7	491.0
Animal and Vegetable Bi-products	Margarine	-1.07	2.7	0.09%	13.9	2.8
Animal and Vegetable Bi-Products	Palm Oil	-2.12	2.1	0.07%	122.0	0.3
Animal and Vegetable Bi-Products	Fish Oil	-1.19	2.0	0.07%	-	6.3
Animal and Vegetable Bi-products	Other Vegetable Oils	-1.13	1.6	0.06%	13.3	2.7
Animal and Vegetable Bi-Products	Glycerol	-0.11	0.4	0.01%	0.9	1.3
Animal Hides	Tanned Sheep Hides	-2.29	11.5	0.39%	0.1	46.7
Animal Hides	Sheep Hides	-1.61	10.8	0.37%	0.2	56.9
Animal Hides	Tanned Goat Hides	-2.34	5.5	0.19%	0.0	27.5
Animal Hides	Equine and Bovine Hides	-0.91	1.5	0.05%	0.4	1.3
Animal Products	Non-Fillet Frozen Fish	-1.63	245.0	8.40%	17.4	62.8
Animal Products	Molluscs	-1.42	80.0	2.70%	2.2	41.5
Animal Products	Non-Fillet Fresh Fish	-1.25	51.1	1.80%	1.3	19.3
Animal Products	Crustaceans	-1.94	42.0	1.40%	0.2	9.4
Animal Products	Fish Fillets	-1.10	32.6	1.10%	-	8.6
Animal Products	Concentrated Milk	-0.79	14.0	0.48%	67.9	3.1
Animal Products	Processed Fish	-1.45	9.2	0.32%	0.4	9.0
Animal Products	Fermented Milk Products	-0.09	2.3	0.08%	1.5	2.9
Animal Products	Other Inedible Animal Products	-0.72	0.6	0.02%	-	1.5
Arts and Antiques	Sculptures	0.22	0.8	0.03%	0.2	1.7
Chemical Products	Phosphoric Acid	-0.02	149.0	5.10%	-	223.0
Chemical Products	Mixed Mineral or Chemical Fertilizers	-0.98	31.1	1.10%	19.2	8.1
Chemical Products	Beauty Products	0.52	26.6	0.92%	8.2	4.5
Chemical Products	Packaged Medicaments	0.82	13.4	0.46%	190.0	0.5
Chemical Products	Nitrogenous Fertilizers	-1.07	9.8	0.34%	56.9	2.2
Chemical Products	Antiknock	1.02	9.3	0.32%	21.5	4.2
Chemical Products	Cleaning Products	0.14	7.9	0.27%	10.9	1.5
Chemical Products	Scented Mixtures	0.29	7.4	0.25%	32.5	2.0
Chemical Products	Perfumes	0.14	5.9	0.20%	4.8	2.2
Chemical Products	Dental Products	-0.04	2.7	0.094	3.7	3.1
Chemical Products	Soap	-1.20	2.5	0.08%	16.9	2.2
Chemical Products	Pesticides	0.00	2.5	0.08%	17.4	0.5
Chemical Products	Enzymes	0.45	1.2	0.04%	3.8	1.4
Chemical Products	Vegetable Alkaloids	0.08	1.1	0.04%	1.5	2.9

Category	Product	PCI	Export Value	Share of Exports	Import Value	RCA
Chemical Products	Detonating Fuses	-0.40	0.3	0.01%	0.9	1.2
Foodstuffs	Soups and Broths	-0.39	100.0	3.50%	9.2	187.0
Foodstuffs	Processed Tobacco	-0.49	51.7	1.80%	3.7	50.6
Foodstuffs	Rolled Tobacco	-0.68	49.2	1.70%	2.3	12.9
Foodstuffs	Raw Tobacco	-1.72	34.4	1.20%	66.4	16.5
Foodstuffs	Malt Extract	-0.12	31.1	1.10%	141.0	9.8
Foodstuffs	Processed Fish	-1.44	19.4	0.67%	1.6	7.3
Foodstuffs	Processed Crustaceans	-1.63	9.4	0.32%	0.0	5.6
Foodstuffs	Animal Meal and Pellets	-1.36	7.6	0.26%	1.2	7.3
Foodstuffs	Ground Nut Meal	-1.82	6.3	0.22%	0.6	730.0
Foodstuffs	Chocolate	0.36	5.6	0.19%	-	1.3
Foodstuffs	Baked Goods	-0.30	4.6	0.16%	9.3	1.2
Foodstuffs	Sauces and Seasonings	-0.49	4.3	0.15%	8.9	2.3
Foodstuffs	Coffee and Tea Extracts	-0.54	2.4	0.08%	-	1.8
Foodstuffs	Pasta	-1.32	2.2	0.07%	8.2	1.5
Foodstuffs	Processed Tomatoes	-1.02	2.1	0.07%	8.3	2.7
Foodstuffs	Other Vegetable residues	-0.30	1.7	0.06%	2.7	1.3
Foodstuffs	Fruit Juice	-0.82	1.3	0.08%	11.3	1.3
Foodstuffs	Alcohol >80% ABV	-1.32	1.3	0.04%	0.4	1.0
Foot- and Headwear	Fake Hair	-2.43	34.0	1.20%	9.7	71.2
Foot- and Headwear	Rubber Footwear	-1.44	2.8	0.10%	7.7	1.1
Foot- and Headwear	Other Headwear	0.14	0.7	0.02%	0.8	1.4
Machines	Insulated Wire	-0.43	16.2	0.56%	26.4	2.7
Machines	Electric Generating Sets	1.18	12.7	0.44%	44.9	2.7
Machines	Excavating Machinery	0.35	6.5	0.22%	41.5	0.3
Machines	Other Construction Vehicles	-0.73	6.1	0.21%	17.5	2.9
Machines	Electric Motor Parts	0.69	4.0	0.14%	7.4	1.4
Machines	Woodworking Machines	0.65	2.4	0.08%	1.0	2.1
Machines	Water and Gas Generators	0.58	0.3	0.01%	0.9	1.8
Metals	Scrap Iron	-0.73	24.3	0.84%	0.1	3.4
Metals	Raw Iron Bars	-1.10	19.4	0.67%	28.0	5.5
Metals	Other Iron Bars	0.06	18.4	0.63%	5.2	34.9
Metals	Scrap Copper	-1.15	13.2	0.45%	-	3.1
Metals	Cold-Rolled Iron	-0.02	10.3	0.35%	14.1	3.3
Metals	Copper Wire	-0.32	9.8	0.34%	22.5	2.9
Metals	Hot-Rolled Iron Bars	-0.24	9.7	0.33%	69.2	4.9
Metals	Other Small Iron Pipes	-0.46	8.9	0.31%	11.5	2.1

Category	Product	PCI	Export Value	Share of Exports	Import Value	RCA
Metals	Coated Flat-Rolled Iron	0.92	8.4	0.29%	22.8	1.0
Metals	Iron Blocks	-0.23	7.3	0.25%	19.4	2.9
Metals	Raw Lead	-1.35	6.4	0.22%	-	5.7
Metals	Scrap Aluminum	-0.84	6.0	0.20%	-	2.6
Metals	Hot-Rolled Iron	0.33	5.7	0.20%	12.0	4.5
Metals	Large Flat-Rolled Iron	0.97	2.0	0.07%	5.0	2.5
Metals	Iron gas containers	-0.52	0.9	0.03%	5.2	1.6
Metals	Razor Blades	-0.11	0.9	0.03%	2.4	1.0
Metals	Iron Ingots	-0.70	0.3	0.01%	-	1.6
Mineral Products	Refined Petroleum	-0.95	235.0	8.10%	1300.0	1.7
Mineral Products	Cement	-1.08	180.0	6.20%	0.8	83.2
Mineral Products	Calcium Phosphates	-1.45	52.3	1.80%	-	87.9
Mineral Products	Salt	-1.15	21.5	0.74%	1.5	40.0
Mineral Products	Clays	-0.48	16.7	0.58%	0.3	48.2
Mineral Products	Titanium Ore	-1.70	11.5	0.40%	-	32.1
Mineral Products	Niobium, Tantalum, Vanadium and Zirconium Ore	-2.36	7.0	0.24%	-	25.2
Mineral Products	Petroleum Coke	-0.45	6.2	0.21%	28.1	1.8
Mineral Products	Petroleum Gas	-2.04	6.0	0.21%	98.7	0.8
Mineral Products	Kaolin	0.04	3.4	0.12%	-	11.1
Mineral Products	Petroleum Jelly	-0.34	2.3	0.08%	5.8	3.5
Mineral Products	Other Mineral	-1.04	2.1	0.71%	-	7.1
Mineral Products	Manganese Ore	-2.23	0.8	0.03%	-	1.0
Mineral Products	Granite	-1.03	0.6	0.02%	0.1	1.7
Paper Goods	Paper Containers	-0.46	8.5	0.29%	25.3	2.4
Paper Goods	Paper Labels	-0.25	1.2	0.04%	3.0	1.4
Paper Goods	Uncoated Kraft Paper	0.12	1.1	0.04%	25.6	0.5
Paper Goods	Toilet Paper	0.18	0.8	0.03%	20.1	0.2
Plastics and Rubbers	Plastic Housewares	-0.73	7.9	0.27%	10.7	2.9
Plastics and Rubbers	Plastic Lids	-0.46	7.8	0.27%	36.9	1.0
Plastics and Rubbers	Propylene Polymers	0.15	5.4	0.18%	27.9	0.5
Plastics and Rubbers	Other Plastic Sheeting's	0.51	5.3	0.18%	10.2	1.3
Plastics and Rubbers	Ethylene Polymers	0.08	3.3	0.11%	39.0	0.2
Precious Metals	Gold	-2.26	361.0	12.00%	0.9	6.8
Precious Metals	Silver	-0.56	7.3	0.25%	0.0	1.9
Stone and Glass	Glass Bottles	-0.55	2.8	0.10%	9.5	1.8
Textiles	Raw Cotton	-2.41	21.7	0.75%	-	8.5
Textiles	Processed Synthetic Staple Fibers	0.08	20.3	0.70%	27.1	751.0

Category	Product	PCI	Export Value	Share of Exports	Import Value	RCA
Textiles	Packing Bags	-1.86	4.5	0.15%	15.2	5.1
Textiles	Non-Knit Women's Undergarments	-1.68	2.3	0.08%	1.2	5.8
Textiles	Awnings, Tents, and Sails	-1.17	2.3	0.08%	1.2	3.9
Textiles	Wadding	-0.22	1.6	0.06%	0.5	4.0
Textiles	Artificial Filament Yarn Woven Fabric	-0.09	0.7	0.02%	1.4	2.5
Transportation	Planes and Helicopters	0.02	28.4	0.97%	2.2	4.2
Transportation	Delivery Trucks	0.38	13.4	0.46%	100.0	6.9
Transportation	Special-Purpose Ships	-0.80	11.4	0.39%	1.4	2.0
Transportation	Cars	0.61	10.5	0.36%	177.0	0.2
Transportation	Armored Vehicles	0.55	7.2	0.25%	26.8	22.4
Transportation	Specialized Vehicles	-0.63	4.3	0.15%	23.7	1.9
Transportation	Railway Cargo Containers	-1.22	2.7	0.09%	9.2	4.1
Transportation	Work Trucks	-0.02	2.7	0.09%	0.8	10.7
Transportation	Other Sea Vessels	-0.24	0.7	0.03%	3.7	1.1
Vegetable Products	Rice	-2.23	41.4	1.40%	413.0	10.1
Vegetable Products	Coconuts, Brazil Nuts, and Cashews	-2.61	36.5	1.30%	0.9	33.5
Vegetable Products	Tomatoes	-1.31	33.4	1.10%	0.4	21.9
Vegetable Products	Legumes	-1.76	26.3	0.91%	0.2	112.0
Vegetable Products	Melons	-1.64	26.0	0.89%	-	49.6
Vegetable Products	Other Vegetables	-1.25	21.6	0.74%	0.9	10.1
Vegetable Products	Tropical Fruit	-1.87	19.9	0.62%	1.9	12.7
Vegetable Products	Ground Nuts	-2.05	9.6	0.33%	-	26.5
Vegetable Products	Tea	-2.12	5.0	1.17%	18.1	4.4
Vegetable Products	Other Oily Seeds	-2.44	4.3	0.15%	-	4.6
Vegetable Products	Onions	-1.81	4.1	0.14%	45.8	4.7
Vegetable Products	Insect Resins	-2.52	3.7	0.13%	-	25.8
Vegetable Products	Cereal Flours	-1.10	3.2	0.11%	2.0	21.1
Vegetable Products	Wheat Flours	-1.28	3.2	0.11%	1.3	3.9
Vegetable Products	Cassava	-2.41	2.6	0.09%	-	5.1
Vegetable Products	Frozen Vegetables	-0.74	2.4	0.08%	0.6	2.3
Vegetable Products	Root Vegetables	-0.72	2.1	0.02%	-	7.4
Vegetable Products	Dried Legumes	-2.06	2.0	0.07%	3.2	1.2
Vegetable Products	Locust Beans, Seaweed, Sugar Beet, Cane for Food	-1.80	1.2	0.04%	-	3.8
Vegetable Products	Perfume Plants	-1.88	0.6	0.07%	0.1	1.2
Vegetable Products	Cereal Meal and Pellets	-0.67	0.5	0.02%	13.3	2.1
Weapons	Other Firearms	0.45	0.9	0.03%	0.5	3.8
Wood Products	Plaiting Products	-1.80	3.7	0.13%	0.1	46.3

Category	Product	PCI	Export Value	Share of Exports	Import Value	RCA
Wood Products	Plywood	-0.82	1.7	0.06%	10.7	0.8
Wood Products	Basketwork	-1.85	1.0	0.04%	0.2	4.1
Wood Products	Wood Ornaments	-0.94	0.3	0.01%	0.1	1.0