



Ministry of Foreign Affairs

# *Senegal Agricultural Value Chain Study*

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**SENSE**

## Senegal Agricultural Value Chain Study

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## Preface

### A promising future in agriculture

Senegal is expanding its food production with great ambition to serve consumers and spur rural development. Products of Senegalese farmers find their way to not only domestic customers but also to export markets in West Africa and the European Union. Dutch growers realized long ago that local circumstances are very favourable for the production of high-quality, nutritious agricultural products. The relative proximity to Europe and accessibility of the wider Sahel region make Senegal an attractive partner for close cooperation.

Partly due to climatic conditions, agriculture in Senegal certainly faces challenges, such as water scarcity and soil salinity. Dutch modern technology and expertise can support (further) improvement of overall performance and sustainability of production, post-harvest handling and marketing. It goes without saying that this will benefit Senegalese farmers to produce in a more sustainable, and profitable manner. Dutch innovative technologies could improve, for example, the use of quality seeds, precision agriculture, storage and packaging.

This 'scoping study' has analyzed those value chains in Senegalese agriculture to which Dutch expertise and technology can have the most added value for improved overall performance. In the framework of the study, a number of specific business cases have been developed, which could enable Senegalese and Dutch partners to cooperate (more) successfully. The overarching objective is to build a sustainable partnership between Senegal and the Netherlands around agriculture.

I thank the consultants of Sense for their good work. For more information on the study or advice, please contact our agricultural experts through [DAK-LNV@minbuza.nl](mailto:DAK-LNV@minbuza.nl).



**H.E. Mrs. Joan J.J. Wiegman**  
Ambassador of the Kingdom of the Netherlands to  
Senegal

## Préface

### Un avenir prometteur pour l'agriculture

Le Sénégal développe sa production alimentaire avec une grande ambition de servir les consommateurs et d'accroître le bien-être en milieu rural. Au Sénégal les produits agricoles sont vendus dans les loumas, les marchés locaux, et sont également destinés à l'exportation en Europe et dans les pays de la sous-région. Depuis quelques années, des producteurs néerlandais ont investi le Sénégal pour la fabrication des aliments nutritifs de très bonne qualité et pour son personnel qualifié et engagé. Du fait de sa proximité géographique avec l'Europe et l'accès facile aux pays du Sahel, le Sénégal demeure une excellente destination pour les affaires.

Cependant, l'agriculture sénégalaise est confrontée à plusieurs défis qui l'empêchent de prendre son envol notamment l'amélioration de l'agriculture durable en plein champ, le renforcement des produits post-récolte, du contrôle de la qualité et de la commercialisation; l'utilisation efficace des intrants et réduction des pertes alimentaires dans la production agricole (gestion de l'eau, fertilisation des sols, utilisation des semences de qualité). De par leur expérience, les entreprises néerlandaises pourraient être un grand atout pour l'agriculture sénégalaise. En effet au vu de cette situation, les investisseurs néerlandais sauront contribuer à amélioration de la performance globale de la production et du marketing en utilisant des technologies modernes qui rendent l'agriculture plus attrayante pour les jeunes professionnels tels que les semences de qualité, l'agriculture de précision, le stockage et l'emballage des produits agricoles.

Cette étude de cadrage agricole a fourni une analyse de certaines chaînes de valeur stratégiques de l'agriculture sénégalaise où la technologie néerlandaise peut contribuer à de meilleures performances et à des positions considérables sur les marchés de consommation. Il a également développé des analyses de rentabilisation tangibles pour que les partenaires néerlandais et sénégalais coopèrent et créent conjointement des entreprises prospères. Pour de plus amples renseignements ou des conseils, vous pouvez communiquer avec nos experts en agriculture à l'adresse [DAK-LNV@minbuza.nl](mailto:DAK-LNV@minbuza.nl)

**L'Ambassadeur des Pays Bas à Dakar**  
**Son Excellence Mme Joan Wiegman**

## Introduction (version française à la page 5)

**This agricultural value chain study provides an overview of 5 key value chains in Senegal- mango, onions, potatoes, European Summer vegetables and poultry and eggs. The ambition was to identify opportunities and bottlenecks in each chain. Then, to pinpoint opportunities for intervention that could in some measure tackle critical issues of food security, inclusion of women and youth and environment sustainability.**

There is great potential in Senegal. In the mango value chain they are able to supply varieties that are in demand in the global fresh mango market in a unique production window. Established infrastructure, an organised sector and good relationships with EU importers means that production of mangoes has been steadily growing in the Centre and Niayes regions as well as along the newer production zone along the Senegal River Valley. These are however not the biggest producing area for mango. The Casamance which lies south of the Gambia has large supplies of mangoes that are currently not being fully exploited commercially. Development of the Port of Ziguinchor promises to close a critical logistics gap. However, the low yielding and disorganised “backyard”-method of production, haphazard fruit collection and an absence of pack-house infrastructure all suggest that this might be a location better suited to processing. More will need to be done to better understand this opportunity.

Growing demand for quality onions and potatoes means that Senegal is a major player in the import trade with the Netherlands. However, local production is taking place. In the case of potatoes at both the small scale and industrial level. A variety of factors combine to ensure that post-harvest losses are significant, with most produce unfit for storage. Yet, industrial production- which has been expanding in recent years- suggests that Senegal can become better at supplying onions locally, with great potential to become a supplier to the region.

Poultry production in Senegal has been growing in leaps and bounds. As with many developed poultry sectors around the world, production follows a “two track system”- large industrial on one end, with small scale production on the other. This industrialisation of production and increases in general efficiency have meant that growth in production has outpaced demand. Without an outlet for chicken and eggs- both in terms of new live-chicken markets domestically, or in the region; in the food services sector or a shift to frozen chicken it’s difficult to see how they could continue to grow.

Senegal has also enjoyed growth in the production of European vegetables such green beans, sweet corn, salad onions, tomatoes and radish. Just as EU producers ramp down production in the winter months, cooler temperatures in the Niayes and along some parts of the Senegal River Valley enable this country to begin supply to the EU. The proximity to this market along with road connections enable producers here to supply daily shipments within days of harvest. Attractive foreign investment policy has ensured that European investors have been able to develop operations that are vertically integrated. This is increasingly seen as an important factor in being able to meet the stringent phytosanitary and food safety requirements of European retailers.

While there are many opportunities in Senegal, significant bottlenecks mean that these value chains have the potential to further contribute to food security and improved livelihoods, the inclusion of women and youth in the economy, and even environmental sustainability.

Firstly, improved **market linkages** would be beneficial. In the case of onions and potatoes this would mean facilitating access to premium markets and in so doing providing an incentive to improve farming techniques and reduce waste. In the case of poultry, this would require a mapping of a route whereby small scalars and industrial producers can have smooth access to consumer and food services markets.

Secondly, a focus on **sustained competitiveness** would be helpful. There are opportunities to close the yield gap between Senegal and other major mango producing nations- both through wider use of improved techniques as well as the expansion of professional mango orchards. In the poultry sector- where every efficiency counts- there is an argument to be made for local hatching egg production. In onion and potato production small scalars can benefit from improved farming techniques, better inputs and mechanisation. Finally, amongst large industrial producers more can be done to integrate sustainable farming techniques and protect current productivity.

A third area of intervention could be in laying the **groundwork** for future development. In the case of onions and potatoes, a critical seed systems design is needed to clarify how farmers will access reliable seed at the appropriate moments in the season. Is local production or seed multiplication a viable route? Developing a supply of certified seedlings for the mango chain would be helpful in laying the foundations for long-term reliable yields. Access to finance and agri-insurance are critical to the overall expansion of production, but especially to creating a pathway for women and youth to participate as entrepreneurs in these new areas of activity. Expanding production has however been placing greater strain on the existing water resources. At the same time farming techniques such as heavy fertiliser use, injudicious irrigation and leaving land fallow in the hot summer months all contribute to salinisation of the soil. This poses a significant threat to sustained productivity and climate resilience. Water management and land use planning are critical skills that will need to be developed and implemented.

**Developing knowledge** is critical to ensuring sustainability of these value chains. Becoming better at both adopting and adapting techniques from abroad could be a key solution to current agricultural challenges. It could also provide the needed tools to be able to respond to climate change- whatever challenges this raises.

In many respects Dutch commercial enterprises, knowledge centres and development aid have the needed blend of technology, know-how and strategic interest to contribute to resolving these bottlenecks. The Netherlands is a major producer and net exporter of onions, potatoes and poultry. In the summer months they're major suppliers of European vegetables in the EU. For these reasons, the sector is rich with expertise, input suppliers and technology- all key ingredients needed to clear bottlenecks in these chains. And many actors in these chains believe that there's a need to move up the value chain or export technology as the next logical step in their development trajectory. The Netherlands is a key hub for worldwide sourcing and distribution of mango across Europe. So, contributing to sustained production of quality fruit is sensible and mutually beneficial. Finally, while the Netherlands and Senegal are poles apart when it comes to climate, both are under increased pressure to use natural resources wisely and to get maximum productivity from each hectare of farmland and Euro of inputs. All this while safeguarding the environment.

Consequently, there are many areas where cooperation could bring meaningful advances to food security, livelihoods, the inclusion of women and youth in the economy as well as environmental and socio-economic sustainability.

## Introduction

**Cette étude sur les chaînes de valeur agricoles donne un aperçu des 5 principales chaînes de valeur au Sénégal : mangues, oignons, pommes de terre, légumes d'été européen et volailles et œufs. Son but est d'identifier les possibilités et les freins dans chaque chaîne. Elle vise également à identifier les possibilités d'intervention qui pourraient dans une certaine mesure s'attaquer aux problèmes fondamentaux de la sécurité alimentaire, de l'inclusion des femmes et des jeunes et de l'environnement durable.**

Le Sénégal a un grand potentiel. S'agissant de la chaîne de valeur de la mangue, le Sénégal est en mesure de fournir des variétés qui sont demandées sur le marché mondial de la mangue fraîche et ce, dans une fenêtre de production unique. Grâce à des infrastructures bien établies, un secteur organisé et de bonnes relations avec les importateurs de l'UE, la production de mangues n'a cessé de croître dans les régions du Centre et des Niayes ainsi que dans la nouvelle zone de production située le long de la vallée du fleuve Sénégal. Ces régions ne sont cependant pas les plus grandes productrices de mangues. La Casamance, qui se trouve au sud de la Gambie, dispose de grandes réserves de mangues qui ne sont pas encore pleinement exploitées commercialement. Le développement du port de Ziguinchor promet de combler une grave lacune logistique. Toutefois, le faible rendement et la méthode de production (familiale et désorganisée), la cueillette aléatoire des fruits et l'absence d'infrastructures de conditionnement sont autant d'éléments qui laissent penser que ce lieu pourrait mieux convenir à la transformation. Il faudra faire plus d'efforts pour mieux comprendre cette option.

La demande croissante d'oignons et de pommes de terre de qualité fait du Sénégal un acteur majeur dans le commerce d'importation avec les Pays-Bas. Cependant, la production se fait aussi localement ; aussi bien à petite échelle qu'à un niveau industriel pour ce qui est des pommes de terre. Plusieurs facteurs combinés expliquent les considérables pertes après récolte, la plupart des produits ne pouvant être stockés. Pourtant, la production industrielle (en hausse ces dernières années) suggère que le Sénégal peut s'améliorer en ce qui concerne l'approvisionnement local en oignons. En effet, il a le potentiel pour devenir un fournisseur de la région.

La production de volailles au Sénégal a connu une croissance fulgurante. Comme pour de nombreux secteurs avicoles développés dans le monde, la production suit un « système à deux voies » : la grande industrie d'un côté, et la production à petite échelle de l'autre. Cette industrialisation de la production et l'augmentation de l'efficacité générale ont fait que la croissance de la production a dépassé la demande. Sans débouché pour les poulets et les œufs (que ce soit en termes de nouveaux marchés de poulets vivants au niveau national ou régional) dans le secteur de la restauration ou sans passer à la production de poulets congelés, il est difficile de voir comment les producteurs pourraient continuer à se développer.

Le Sénégal a également connu une croissance de la production de légumes européens tels que les haricots verts, le maïs doux, les ciboules, les tomates et les radis. Les producteurs de l'UE réduisant leur production pendant les mois d'hiver, les températures plus fraîches dans les Niayes et le long de certaines parties de la vallée du fleuve Sénégal permettent à ce pays de commencer à approvisionner l'UE. La proximité de ce marché ainsi que les liaisons routières permettent aux producteurs de faire des livraisons quotidiennes dans les jours qui suivent la récolte. Une politique d'investissement étranger attrayante a permis aux investisseurs européens de développer des opérations intégrées verticalement. Une plus grande importance est donnée à ce facteur pour

pouvoir répondre aux strictes exigences phytosanitaires et de sécurité alimentaire des détaillants européens.

Bien qu'il existe de nombreuses possibilités au Sénégal, des freins importants signifient que ces chaînes de valeur ont le potentiel de contribuer davantage à la sécurité alimentaire et à l'amélioration des moyens de subsistance, à l'inclusion des femmes et des jeunes dans l'économie, et même à la protection de l'environnement.

Pour tirer parti de ce potentiel, il serait tout d'abord bon d'améliorer les **liens avec le marché**. Dans le cas des oignons et des pommes de terre, cela faciliterait l'accès aux marchés à primes et, ce faisant, inciterait à améliorer les techniques agricoles et à réduire les déchets. Dans le cas de la volaille, il faudrait cartographier un itinéraire permettant aux petits exploitants et aux producteurs industriels d'avoir un accès aisé aux marchés des consommateurs et de la restauration.

En outre, il serait utile de mettre l'accent sur la **compétitivité durable**. Il est possible de combler l'écart de rendement entre le Sénégal et les autres grands pays producteurs de mangues, à la fois en utilisant plus largement des techniques améliorées et en agrandissant les vergers de mangues professionnels. Dans le secteur de la volaille (où chaque mesure améliorant l'efficacité compte), il conviendrait de produire des œufs à couver localement. En ce qui concerne la production d'oignons et de pommes de terre, des techniques agricoles améliorées, de meilleurs intrants et la mécanisation peuvent être bénéfiques aux petits producteurs. Enfin, chez les grands producteurs industriels, plus d'efforts peuvent être faits pour intégrer des techniques agricoles durables et protéger la productivité actuelle.

Un troisième domaine d'intervention pourrait consister à poser les **fondements** pour les évolutions à venir. Pour ce qui est des oignons et des pommes de terre, il est nécessaire de concevoir des systèmes de semences, indispensables pour clarifier comment les agriculteurs auront accès à des semences fiables aux bons moments de la saison. La production locale ou la multiplication des semences est-elle une voie viable ? Il serait utile de développer une offre de plants certifiés pour la chaîne de la mangue pour poser les fondements de rendements fiables à long terme. L'accès au financement et à l'agri-assurance sont essentiels à l'expansion mondiale de la production, mais surtout à la création d'un parcours permettant aux femmes et aux jeunes de participer, en tant qu'entrepreneurs, à ces nouveaux domaines d'activité. Toutefois, l'expansion de la production a mis à rude épreuve les ressources en eau existantes. Dans le même temps, les techniques agricoles telles que l'utilisation massive d'engrais, l'irrigation malavisée et la mise en jachère des terres pendant les chauds mois d'été contribuent toutes à la salinisation des sols. Ces techniques constituent une menace importante pour la productivité durable et pour les capacités d'adaptation aux effets du changement climatique. La gestion de l'eau et la planification de l'utilisation des sols sont des compétences essentielles qui devront être renforcées et mises en œuvre.

D'autre part, il est essentiel d'**acquérir des connaissances** pour assurer la durabilité de ces chaînes de valeur. L'une des solutions clés aux défis agricoles actuels serait de mieux adopter et adapter les techniques provenant de l'étranger. Cela pourrait également apporter les outils nécessaires pour pouvoir répondre au changement climatique, quels que soient les défis qu'il pose.

À de nombreux égards, les entreprises commerciales, les centres de connaissances et l'aide au développement néerlandais possèdent le mélange nécessaire de technologie, de savoir-faire et d'intérêt stratégique pour contribuer à la suppression de ces freins. Les Pays-Bas sont un

important producteur et un exportateur net d'oignons, de pommes de terre et de volailles. Pendant les mois d'été, ils sont les principaux fournisseurs de légumes européens dans l'UE. Pour ces raisons, le secteur est riche en expertise, en fournisseurs d'intrants et en technologie, tous des ingrédients clés nécessaires pour supprimer les freins dans ces chaînes. De nombreux acteurs de ces chaînes estiment qu'il est nécessaire de remonter la chaîne de valeur ou la technologie d'exportation comme prochaine étape logique de leur axe de développement. Les Pays-Bas sont une plaque tournante essentielle pour l'approvisionnement et la distribution de mangues en Europe. Il est donc judicieux et mutuellement bénéfique de contribuer à une production durable de fruits de qualité. Enfin, alors que les Pays-Bas et le Sénégal sont aux antipodes en matière de climat, ils subissent tous deux une pression accrue pour utiliser judicieusement les ressources naturelles et pour obtenir une productivité maximale de chaque hectare de terre agricole et de chaque euro d'intrants. Tout cela en préservant l'environnement.

Par conséquent, il existe de nombreux domaines dans lesquels la coopération pourrait donner lieu à des avancées significatives en matière de sécurité alimentaire, de moyens de subsistance, d'inclusion des femmes et des jeunes dans l'économie ainsi que de durabilité environnementale et socio-économique.



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## Senegal Value Chain Study - Mango



## 1 Executive Summary

Globally, the demand for mangoes and mango products has been increasing. Fresh mangoes are now available year round in Europe, with mango juice quickly becoming a key flavour in juice, dairy drinks, ice-creams, smoothies and assorted snacks.

South American producers dominate the overall volumes being imported by the EU. Much of the fresh fruit and juices enter via the Netherlands, before being redistributed across the region. Senegal, in contrast is a far smaller exporter, but it has become an important supplier of export grade mango to the EU in the EU summer months. At this moment in the supply calendar the traditional suppliers Brazil and Peru are not producing, which creates a production window with immense potential.

Within Senegal, the Centre- and Niayes region has emerged as the leading production zone for export grade mangoes in Senegal. It's a fairly organised sector, with professional exporters, who are close to the harbour and who enjoy drier conditions that allow for lower phytosanitary pressure. Production has been growing, but there are still opportunities to expand the production of export grade mango. This could be driven both by increasing the land under cultivation and the overall yields. While current yields are good when held up against the historic benchmark, Senegalese producers are increasingly lagging behind some of the more advanced counterparts in South Africa. Key to closing this yield gap will be developing knowledge and new techniques around pruning, orchard planning and the application of fertilisers.

An expanding fresh fruit sector comes with in-built challenges around sustainability. Larger areas will need irrigation, more pesticides will be applied and finally more fruit will need to be accommodated in cold storage. Managing waste will also become critical. Efficient fruit production sectors include mechanisms to secure maximum value for each grade of fruit. So, as fresh export production expands, productive commercial uses of the second and third grade fruit will need to be found. This includes a potential expansion of processing, which is in its infancy in Senegal.

This processing opportunity is very relevant to the Casamance. In reality this area produces more mango than the Centre and the Niayes. But the fragmented system of production; the challenges around fruit collection; the distance and complexity of getting fruit to port and a humid climate prone to fruit fly all make processing a far more feasible and appropriate idea for development.

Achieving these ambitions requires a better understanding of the processing opportunity in the Casamance. The varieties have been mapped, but more work will need to be done on understanding the market and opportunities to attract investment. From the perspective of export fruit production in -Centre and the Niayes, more will need to be done to counteract -and slow-salinisation caused by heavy irrigation and fertiliser use. The expansion of industrial production in the Centre and the Niayes raises a fundamental systemic question about the management of water resources in a water-poor area that relies on groundwater for irrigation. In the longer term, to ensure sustainable expansion of agriculture more will need to be done to enhance the land and water resource planning systems.

## Résumé Mangues

Dans le monde entier, la demande de mangues et de produits à base de mangue est à la hausse. Les mangues fraîches sont désormais disponibles toute l'année en Europe, le jus de mangue devenant rapidement une saveur clé dans les jus, les boissons lactées, les glaces, les smoothies et les en-cas assortis.

Les producteurs sud-américains sont en tête des volumes globaux importés par l'UE. Une grande partie des fruits frais et des jus entrent par les Pays-Bas, avant d'être redistribués dans toute la région. Le Sénégal, en revanche, est un exportateur beaucoup plus petit, mais il est devenu un important fournisseur de mangues de qualité export vers l'UE pendant les mois d'été. À cette période, les fournisseurs traditionnels que sont le Brésil et le Pérou ne produisent pas, ce qui crée une fenêtre de production avec un potentiel immense.

Au Sénégal, la région du Centre et des Niayes est devenue la première zone de production de mangues de qualité export. C'est un secteur assez organisé, dont les exportateurs professionnels sont proches du port et bénéficient de conditions plus sèches permettant une pression phytosanitaire moindre. La production a augmenté, mais il existe encore des possibilités d'accroître la production de mangues de qualité export. Cela pourrait se faire à la fois en augmentant les terres cultivées et les rendements globaux. Si les rendements actuels sont bons par rapport aux données historiques, les producteurs sénégalais sont de plus en plus à la traîne par rapport à certains de leurs homologues plus avancés en Afrique du Sud. Pour combler cet écart de rendement, il est essentiel d'acquérir plus de connaissances et d'élaborer de nouvelles techniques en matière d'élagage, de planification des vergers et d'application d'engrais.

L'expansion du secteur des fruits frais s'accompagne de défis inhérents à la durabilité. De plus grandes zones devront être irriguées, davantage de pesticides devront être appliqués et, enfin, davantage de fruits devront être stockés au froid. La gestion des déchets deviendra également essentielle. Les secteurs de production de fruits efficaces comprennent des mécanismes visant à garantir une valeur maximale pour chaque catégorie de fruits. Ainsi, à mesure que la production de fruits frais destinés à l'exportation augmente, il faudra trouver des utilisations commerciales productives pour les fruits de deuxième et troisième catégorie. Cela inclut une expansion potentielle de la transformation, qui n'en est qu'à ses débuts au Sénégal.

Cette possibilité de transformation est très intéressante pour la Casamance. En réalité, cette région produit plus de mangues que le Centre et les Niayes. Mais le système de production fragmenté, les défis liés à la collecte des fruits, la distance et la complexité de l'acheminement des fruits au port et un climat humide propice aux mouches des fruits font de la transformation une idée de développement bien plus réalisable et appropriée. Une meilleure compréhension des possibilités de transformation en Casamance est nécessaire pour atteindre ces objectifs. Les variétés de mangues ont été cartographiées, mais il faudra travailler davantage pour comprendre le marché et les possibilités d'attirer les investissements. Du point de vue de la production de fruits destinés à l'exportation dans le Centre et les Niayes, il faudra faire plus d'efforts pour contrer et ralentir la salinisation causée par l'irrigation massive et par l'utilisation excessive d'engrais. L'expansion de la production industrielle dans le Centre et les Niayes soulève une question systémique fondamentale sur la gestion des ressources en eau dans une région pauvre en eau qui dépend des eaux souterraines pour l'irrigation. À plus long terme, pour assurer une expansion durable de l'agriculture, il faudra travailler à améliorer les systèmes de planification des ressources en terres et en eau.

## 2 Background and Method

The aim of this study is to provide insights into the Senegalese Mango value chain and to define critical interventions that are needed for the sector to flourish. These insights will be used to provide guidance to development and knowledge partners as they work in these intervention areas. Finally, these will be used by the private sector, who at a later stage might be encouraged to trade and deliver much needed equipment, inputs and expertise. Ultimately it is hoped that these interventions will play a useful part in fueling an improvement in the livelihoods and food security of the Senegalese people, while improving the lot of women and youth and the environment.

More specifically the study aims to (i) describe the market, production and enabling environment in the mango value chain in Senegal (ii) reveal the key issues, opportunities and bottlenecks in the value chain (iii) propose specific interventions that can help to address these bottlenecks & allow for the value chain to have greater impact (iv) identify areas where inclusive participation of women and youth in the economy can be stimulated (v) highlight opportunities for improved circular economy practices (vi) recommend areas where public, private and the knowledge sectors can make valuable, if not unique, contribution to these interventions

This study is to a large extent supported by knowledge obtained through a series of projects in the Senegalese Mango sector, and interviews with key stakeholders. The past projects included (1) the development of a supply chain strategy for a mango juice plant in 2017, for which all professional orchards in Centre Niayes and exporters were visited and interviewed, as well as a selection of farmers in Casamance. (2) analysis of the market for processed mango products in the EU, US and Gulf States and the perspective of Senegalese processing companies in 2018. (3) Benchmark study for mango cost of production in Senegal, Ivory Coast, Ghana and South Africa for HortiFresh/ GIZ, for which detailed cost of production analysis was done for large scale plantations and small scale plantations in Senegal, and finally advice regarding export promotion project for the sector to IFC (2019). We interviewed several key stakeholders to assess recent changes in the industry.

We must highlight that this research was carried out during the COVID 19 period, but after local constraints on travel were lifted. This has both advantages and disadvantages. A large number of interviews could be conducted telephonically, which made including a variety of perspectives and experiences from Senegal and the Netherlands far more possible. In some instances, the new “work from home” norm made interviewees more available.

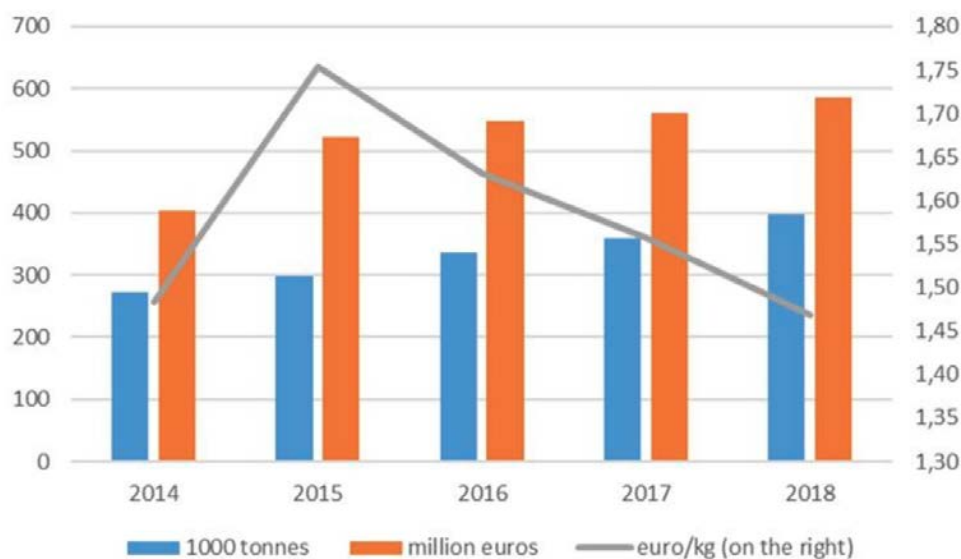
## 3 The Market

### 3.1 The Fresh Fruit Market in the EU

#### 3.1.1 Overview

The volume and value of mango exports to the EU have been increasing steadily over the past decades, though export prices have been decreasing. Figure 1 provides an overview of the import volumes (source: CBI). This shows that the value increase is largely driven by large volume increases. Western Europe is still responsible for the bulk of consumption, with mango still being relatively new and expensive for Eastern Europe.

Figure 1: EU imports of fresh mango by volume and value from 2014 to 2018 (Source: CBI)

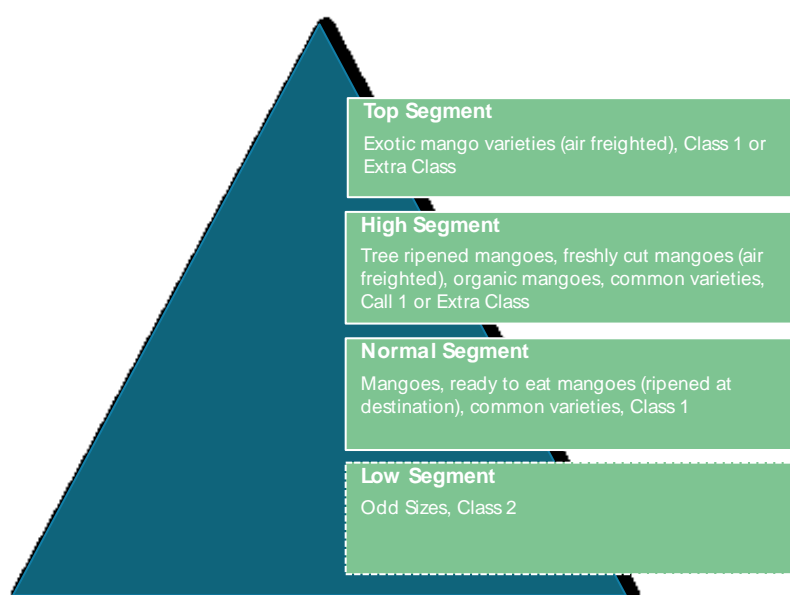


The biggest development over the past decade has been the growth of the ready-to-eat mangoes segment. They are ripened in controlled ripening rooms close to or in the final market so that they can be consumed within on or within a few days of purchase. These mangoes are sold at higher prices. The growth of the ready-to-eat market has had important consequences for suppliers, because for the importers require mango within one container to be uniform in the stage of ripeness. This is more difficult to achieve if you source from small farmers.

### 3.1.2 Product Market Segments

Within the market one can distinguish 4 clear segments. The top segment consists of exotic varieties that are ‘tree ripened’ and air freighted to the EU. Tree ripened means they are harvested closer to maturity and thus have more flavour. Where ripe mango has a sugar content of 14-18 brix, mango destined for export tends to get harvested at 6brix so that it can last 20 to 30 days in transport and distribution. Though the mango does ripen, it never comes close to the flavour of a mango harvested closer to maturity. The high segment consists of so called ‘tree ripened mangoes’, and fresh cut mango salads and organic mango. The normal segment are conventional mangoes of common varieties with the right appearance (minimum 40% red coloration, not noticeable skin blemishes etc.). Finally, the low segment consists of “off-sizes” (often too big) with external blemishes, and or limited shelf life because they are already too ripe. They are often sold to open-air markets where they are resold at discounted prices. They are also used by local processors of fresh cut fruit salads.

Figure 2: Segments in the EU mango market



### 3.1.3 Main Markets Within the EU

**The Netherlands** is by far the biggest importer in the EU and is central to the redistribution of mangoes around Europe. In 2019 the Netherlands imported just over 250 000 tons of mangoes, then re-exported 220 000 tons of that mango across the European region. With a consumption of 30,000 tons the Netherlands is per capita also one of the biggest consumers.

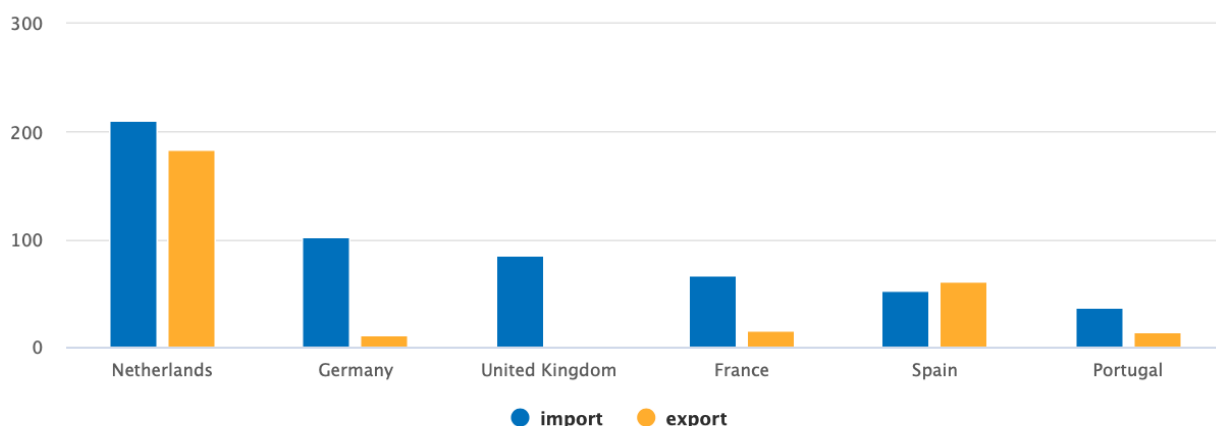
**The UK** is the second-largest importer of mangoes in Europe with over 86,000 tonnes of imports in 2018 but import volumes have been stabilising over the past three years. The stabilisation is a result of a maturing market and the devaluation of the British pound. The UK is a large consumer of air-freighted specialty mango from India and Pakistan. Brexit may put purchasing power further under pressure thereby reducing imports. It may also force UK importers to source directly from other countries. Finally, it is likely to force Irish importers to shift their supply from the UK to other EU countries.

With 66,900 tonnes of imported mangoes and limited exports in 2018, **France** is the third biggest consumer of mango. Mango is a popular fruit in France, but the general preference of consumers for local products will always compete with the import of mangoes. France has been a traditional buyer of West African mango due to the language and cultural links. For example, Ivory Coast exported 10,600 tonnes to France, which is more than mango giant Brazil.

**Germany** is the largest destination market for mango, with a consumption of 89,000 tonnes in 2018, up 55% from five years before and still growing. Germany is mostly supplied from the Netherlands.

**Spain** is the only country in Europe that produces mango. According to FreshPlaza it produced 34,000 tons, in 2018 up 30% from the year before in 2018. Local production based on the Osteen variety has increased local consumption. Spain is also becoming a trade-hub for mango with both imports from developing countries and exports to other EU countries increasing with 72% over the past five years. Most Spanish mangoes go to Portugal (24,400 tons) and France (16,000 tons). Spain can thus be an interesting destination to enter the Southern European market. Portugal is actually per capita the highest consumer of mango in the EU.

Figure 3: Imports and re-exports in the EU in thousands of ton, 2018



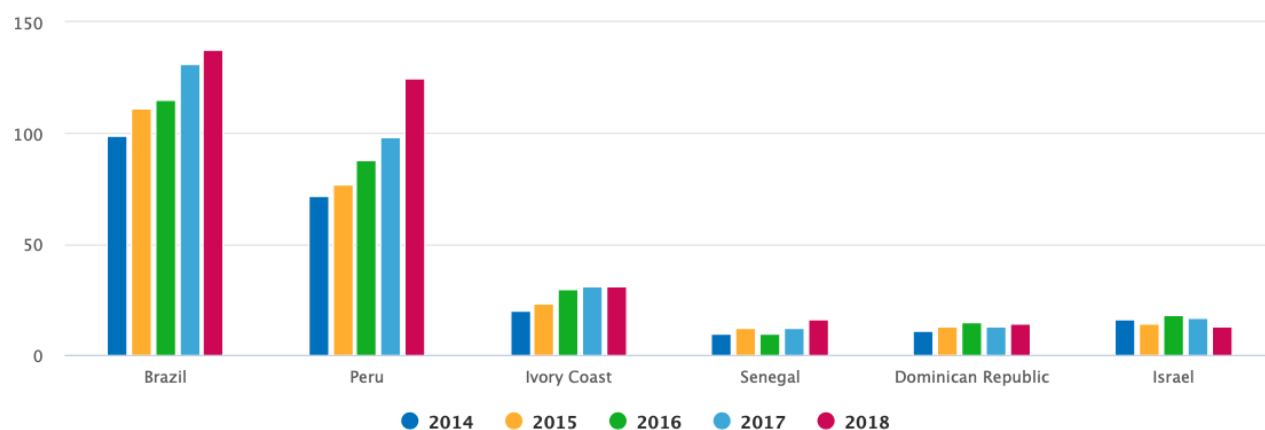
Source: ITC Trademap

Finally, **Belgium** is also increasingly a distribution hub for both air freighted and boat freighted mango, particularly for West African mango. Antwerp is an easy port to use for Dutch traders, and one of the major shipping routes from West Africa lands in Antwerp. Furthermore, it has a reputation for being far less strict on phytosanitary controls than the Netherlands. Many West African exporters who traditionally have issues with fruit fly control prefer to use Antwerp. Finally, SN Brussels airlines offered attractive rates on air freight and a very efficient handling at the airport. It is said that it's faster and cheaper to clear mangoes in Antwerp and truck them to Paris than to land them in Paris directly.

### 3.1.4 Supplying Markets and Seasonality

Most of the EU mango imports originated in Brazil and Peru. Collectively these countries supplied almost half of all fresh mangoes to the region in 2019. In contrast Senegal supplied a tenth of the mangoes that came from Peru. Figure 4 provides an overview of the main suppliers. Figure 5 provides an overview of the supply per season. Other regional suppliers to the EU are Mali and Burkina Faso, but their exports remain limited to about 9000 tons each. Their main challenge are the high transit time and logistical cost because they are landlocked. This doubles their transport cost compared to for example Ivory Coast which operates in the same time window.

Figure 4 EU Fresh Mango Exporters to the EU by Volume in thousands of tons from 2014 -2018 (Source: CBI.EU)



Source: Eurostat / Market Access Database



Seasonality plays a large role in the supply of mango. For the first quarter of the year South American producers Peru, Brazil and the Dominican Republic market their mangoes. From March producers in the Ivory Coast supply. By the middle of the year volumes from these mega-mango producers fall sharply. Senegal and Israel contribute only a portion of the volumes imported at the peak in February and March. Then from October the South American producers begin to market their mangoes & the cycle start again.<sup>1</sup>

Part of the success of Brazil is that it is able to supply Mango all year round due to the large variety of tropical and sub-tropical climates in the country. Peru has been able to increase the length of their production season each year through a smart mix of varieties and techniques to speed-up or delay harvests. The Ivory Coast is the third biggest supplier, but exports only 5 weeks of the year. Figure 5 provides an overview of the production season in a number of producing countries. Though South Africa is mentioned, they no longer export meaningful volumes to the EU, because they have more lucrative markets in the Middle East and locally. Mexico and Ecuador are more oriented versus the US markets. India and Pakistan are too far for transport by boat; they only play in the premium exotic air freight segment.

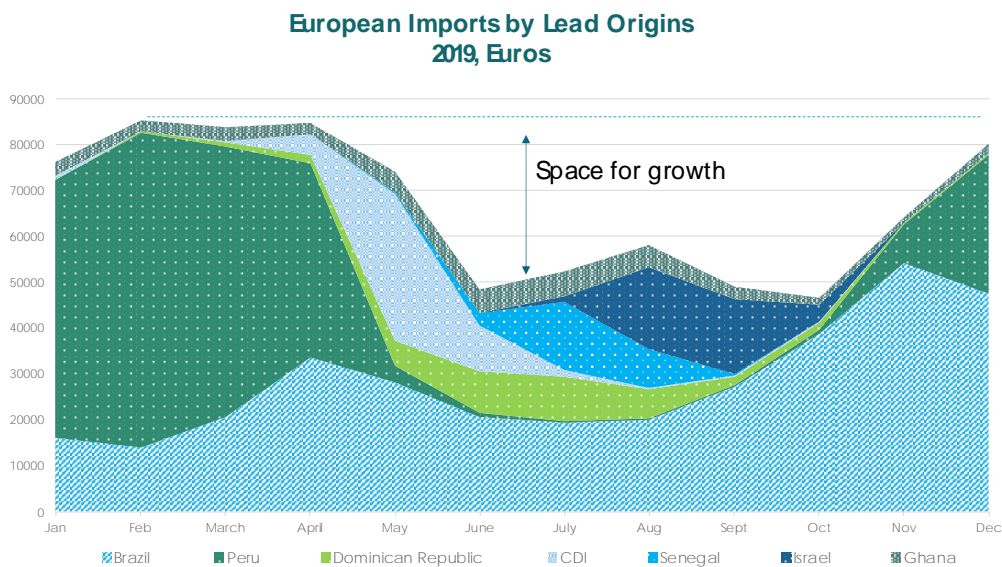
Figure 6 provides an overview of the supply throughout the year of major players. Within this graph, Ghana is an odd one because its numbers are mostly based on fresh cut mango fruit salads prepared with local mangoes as well as mangoes imported from Ivory Coast, Senegal, South Africa, Burkina Faso and other countries. Fresh export in whole fruits from Ghana is less than 1000 tons.

Figure 5 Overview of the Global Mango Season

	J	F	M	A	M	J	J	A	S	O	N	D
Brazil												
Peru												
Ecuador												
South Africa												
Costa Rica												
Mali / Burkina Faso												
Ivory Coast												
Mexico												
Dominican Republic												
Pakistan / India												
Senegal												
Israel												
Spain												

<sup>1</sup> These combined volumes represent 80% of EU imports throughout the year

Figure 6 EU Sourcing Origins (lead markets, 2019, ITC Trade Map)



### 3.1.5 Varieties

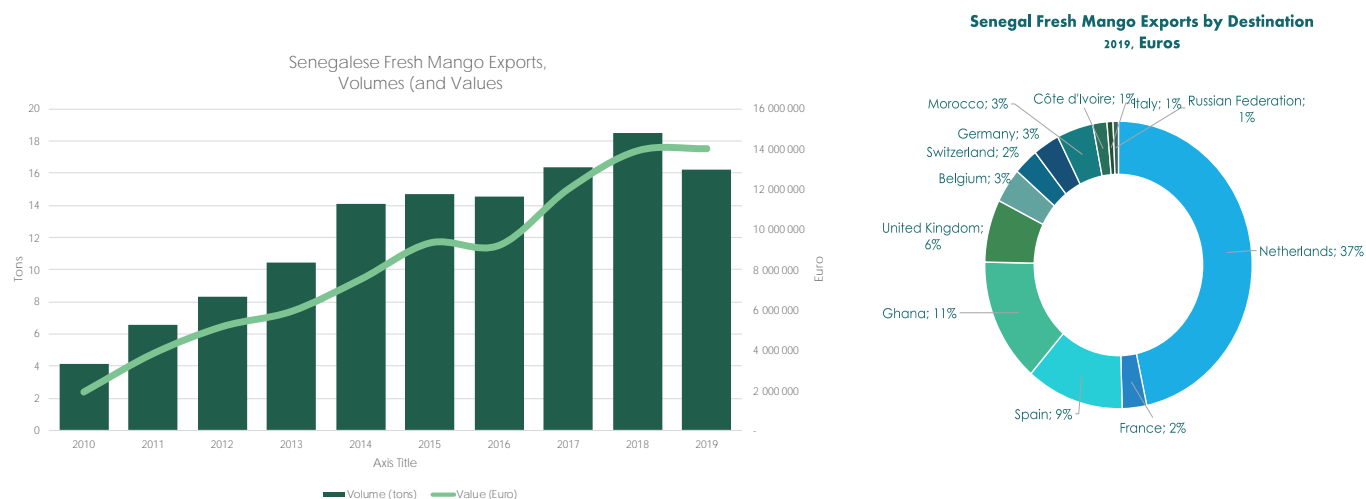
The main mango varieties on the EU fresh market are Kent and Keitt. Tommy Atkins, once the dominant variety, is in decline because it is more fibrous. Osteen is gaining popularity as it is appreciated by consumers. It is the only variety produced in Spain and is increasingly being planted in other countries as a replacement for Tommy Atkins, since both are early season varieties. Palmer from Brazil is also common.

## 3.2 Senegalese Fresh Mango Exports

Buoyed by growing demand in Europe, exports from Senegal have been growing. In 2019 more than 14 000 tons of fresh mango left Senegal, largely for the EU. This was an almost doubling of volumes in a 5-year period. The vast majority of these mangoes were imported by the Netherlands, followed by Spain and France and a number of European countries.

The only real exception is a significant volume (11%) imported by Blue Skies in Ghana for fresh cut mango salads. They use Senegalese mango when the Ghanaian season has ended in order to provide a year-round supply. The fruit salads are packaged directly in consumer packaging and flown out to the EU. However, due to Covid19 this business has taken a massive hit in 2020 because of the absence of passenger flights between Africa and the EU.

Figure 7 Senegalese Export Volumes and destinations (ITC Trade Map)



### 3.3 Local Market - Centre & Niayes

The local fresh market is mostly limited to informal traders who collect truck loads for the local fresh market. This is mostly to the open markets and small retailers, but even larger retailers tend to be supplied by small traders. The traders pay premium prices by West African standards, and this makes the mango too expensive for processing. There is one formal distributor with its own points of sale in the form of tents and small shops, Senfresh. This local fresh market is supplied from the Centre Niayes orchards, as well as Casamance and Mali. Opportunities are in better quality mango supplied over a longer season in more formal retail.

There are currently no professional processing factories that absorb meaningful volumes of mango and thus offer a good market for farmers. Though there are a few processors in dried fruit and juice that have tried, they did not reach the necessary scale to reach impact on the sector. Processing has remained at an artisanal level.

As the mango produced in Senegal is often organic by default, they are able to provide this to the market. In the 2020 season producers were able to achieve a 15% price premium over the conventional price. However, lower global supply means that this is in demand and is a useful product to build relationships with new importers.

### 3.4 Local Market - Casamance

The market available to the producers from Casamance used to be mostly limited to the local surroundings. There were traders sourcing for the Dakar fresh market and even for the Agrofruits juice plant when it was operational. However, the transport was complex and expensive. It involved crossing the border with the Gambia twice and crossing the river by boat. Often different traders were responsible for segments of the route, leading to lots of loading and reloading and adding cost as everyone adds their margin. The cost of gathering in remote orchards, loading trucks, crossing borders and rivers, transport cost and roadblocks can easily triple or quadruple the cost of mango when it arrives in Dakar.

Since the opening of the Senegambia bridge in January 2019 the transport has become much easier and cheaper, improving market access for the Casamance. However, COVID19 has shown the risk of needing to cross borders to reach the Dakar market, as the bridge has been closed so far this year. Hence, it still makes sense to develop the port and transport by sea, in order to have an alternative and also introduce competition to road freight.

### 3.5 Regional Market

A small portion of Senegalese exports in 2019 went to Ghana (1784 tons) and the Ivory Coast (220 tons). The former presumably for the fresh cut fruit export to the EU and for dried fruit production, which is significantly larger in those countries than in Senegal.

There are also smaller volumes of mango transported from by road from Mali to Dakar. The season in Mali starts much earlier, and the farm gate price of mango is about 10% to 25% of the farm gate price in Senegal. However, the cost of getting this Mango to Dakar are high, as it needs to be moved from orchards with small trucks or tricycles before being packaged in boxes and loaded on large trucks. Sometimes mango is transported in bulk with large losses of fruit due to the rough roads. Fees for transport are high despite the fact that many trucks return empty to Dakar. Part of this is due to cost linked to about 13 roadblocks between Bamako and Dakar.

### 3.6 Market for Processed Products

#### 3.6.1 Local Market For Juice

Juice production typically consists of 2 separate business models:

1. A juicing plant, which produces large volumes of a few fruits to be found in abundance around the plant in bulk packaging (210 liter drums). The minimum economic scale is 5 tons of fresh fruit per hour, which needs to run 24/7 for about 3 to 4 months to be profitable, and the typical investment is about 2,5 to 3 million USD.
2. A juice bottler, which purchases a large range of more than 10 different juices and concentrates and blends and bottles juice, and markets this to consumers via a dense network of distributors and wholesalers. A modern Tetra Pak plant is an investment of at least 4 million USD.

Figure 8 Typical Successful Juice Production Models



Figure 9 Local Juice Brand From Kirène

However, in Africa most juice companies try to juice and bottle at the same time. This means they have a limited product range of expensive products in a packaging with limited shelf life. This is a major barrier to being able to market juice products widely. They tend to remain very small niche players, incapable of absorbing meaningful volumes of fruit and competing with mainstream drinks such as coca cola.

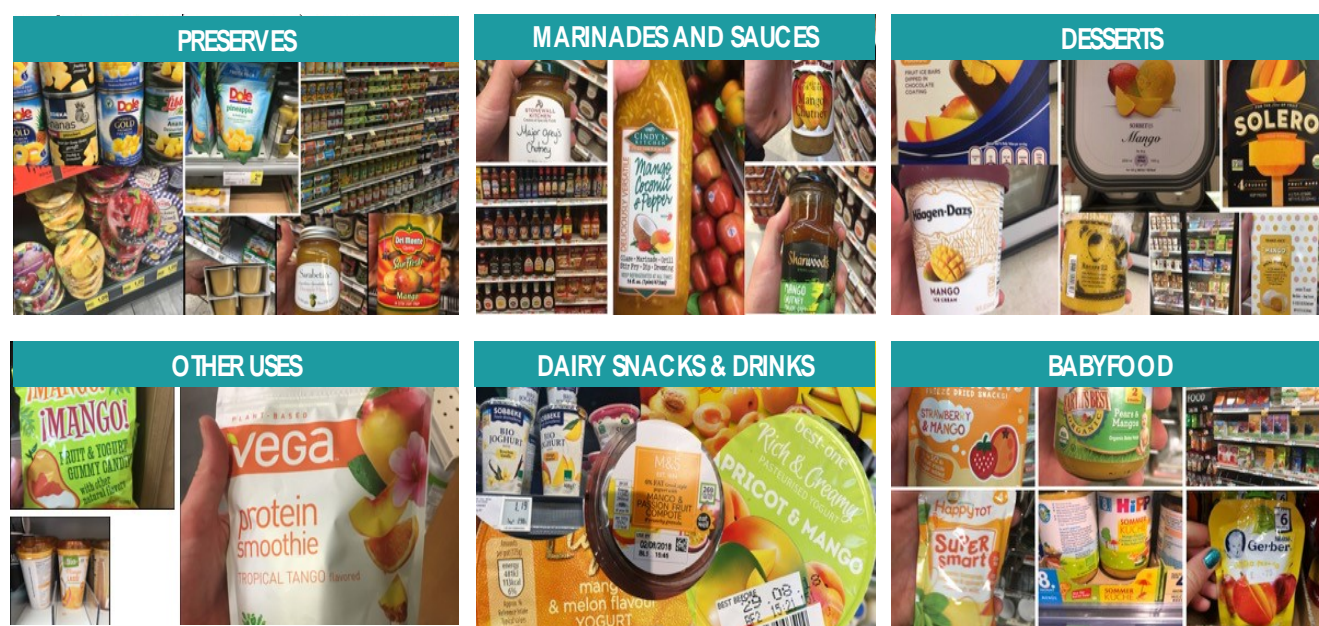
Dakar and surroundings does provide a growing market for juice, which is served by imports and Kirène, a local bottler of soft drinks, juices and mineral water. They bottle large volumes in

modern packaging lines under their own brand, Presseas. Their demand for mango puree is between 1000 and 1500 tons per annum, which is currently met by using their own stock produced 2 years ago. This volume is not sufficient to run a mango pulping plant, but Kiren failed to find sufficient export markets for its mango puree during the three years it operated.

### 3.6.2 Puree for Juice and other Applications(EU&US)

Mango pulp or puree as it is often called is used as an ingredient in food processing. Its biggest use is as a juice ingredient, but it is also used in marinades and sauces, desserts, dairy products and drinks, smoothies, marmalades & jams and baby foods.

Figure 10 Assorted Uses for Mango Concentrate



The standard for mango puree is 14-18 brix (sugar content), aseptic and packaged in an aseptic bag in 210 litre metal drums. Aseptic means the product is sterilised using steam and it can be stored at room temperature. A small percentage of the market is frozen puree, and this is mainly destined for use in dairy products. Dairy products need to be pasteurised at the end and using aseptic mango would mean the mango is heated twice which would reduce flavour and change the colour.

We estimate the current EU market for Mango puree at 42,000 tons per year (single strength equivalent), and slightly larger in the US. The biggest consumers of mango juice are in Western Europe and Southern Europe. In Eastern Europe it is less popular due to the price. There is still space for new suppliers on the market, but competition is fierce. You need to be able to match existing suppliers on value for money. There is a strong demand for organic mango of which there is a shortage. It's difficult to farm Mango organically at a professional level.

The demand for mango puree is still mostly driven by the juice market, which is actually in decline as a whole in the EU and US. However tropical flavours such as Mango, and "not from concentrate" (NFC) juice are growing segments within this declining juice market. Fortunately, pulped mango, also referred to as single strength puree, functions as a concentrate but qualifies as NFC because there has not been any evaporation of water. In fact, to make mango juice, water

needs to be added because the puree is too thick to drink. Most mango juices sold in the EU and US are blends with other cheaper fruits (e.g., apple, grape, pear, orange) and only a small percentage of mango (5% to 20%).

The juice value chain is dominated by importers and so-called compound houses who source, import, blend, standardise and market juice to juice bottlers. For example, they will blend various origins of mango juice to standardise the flavour throughout the year. Or they create multi fruit blends. Bottlers in turn purchase concentrates and NFC juices, blend and bottle. Importers and compound houses source concentrates and juices from juicing plants around the world, sometimes with assistance of agents, but their role is decreasing. Increasingly importers are also investing in their own plants or in strategic relationships with specific production plants in the land of origin.

The juice game is a blending game, where the goal is to reach the most flavour with the most interesting consumer story at the lowest price per litre. Some varieties like Alphonso are more expensive (\$1400/ ton normally, but between \$1100 and \$1600 depending on the season) because they provide more flavour, and thus can be used in lower concentrations in the blend compared to a cheaper Kent or Totapuri (\$550 to \$750 depending on the season, but usually around \$600 to \$650 CNF Rotterdam). Other varieties can deliver an interesting flavour profile and fit somewhere in between in terms of price, e.g., the Magdalena from Colombia, Chato de Ica from Peru or Amélie from Mali and Burkina Faso. The organic premium is around \$100 to \$150 per ton. The upper end of this range is typically achieved by the more valuable varieties such as Alfonso.

Major suppliers into this market are India, Mexico, Brazil, Thailand, Peru and Colombia. Mali currently has two factories for export and Burkina Faso one, but volumes are very small compared to the size of the market. South Africa also exports smaller volumes of Kent, Keitt and Tommy Atkins puree.

Kent and Keitt mango which are dominant varieties in Centre and Niayes are accepted on the market. But, for now does seem to compete directly with the cheaper Totapuri from India and Tommy Atkins from Mexico because Kent and Keitt don't have a particularly strong and specific flavour. We feel they should be able to fetch slightly higher prices because the colour is intense, and the sugar content is higher than other suppliers (18 brix compared to 14-16 brix from other suppliers). However, this has not yet been proven, and Kiréne was struggling to sell its puree at higher prices compared to Indian Totapuri. It may well take some time to build a reputation for this puree that allows it to capture this price premium. Proximity to the market would be a plus, particularly for NFC transport cost.

Non-exportable varieties from Casamance could produce interesting flavours but needs to be tested. Over the past decade Amélie from Mali and Burkina Faso has gained a reputation for supplying good juice that fetches premium prices. Amélie is a variety that is difficult to export fresh but is successfully dried and juiced. More premium varieties could obtain between \$800 and \$1600 per ton. However, at the start a lower price may be needed to get a foothold in the market. Assessing the potential sales price for the varieties in Casamance will require close cooperation with major importers.

### 3.6.3 Frozen Fruit

The market for frozen mango pieces (IQF mango) is still growing, and again non-exportable varieties could potentially be used. Once again organic is an interesting niche and route to market for new unproven producers. Frozen mango pieces have two main end-uses:

- As ingredients for the food industry, particularly for more luxury products where the impression needs to be given to consumers that real pieces of fruit have been used. For example, for yoghurts, ice-creams, smoothies, cakes, baby food etc. This industry mainly used 1cm cubes that in many cases are processed by adding sugar, boiling etc. This is a price sensitive segment where depending on the usage different buying criteria exist. For some applications firmer lighter coloured cubes are preferred, such as Ivorio from China. For other applications a more colourful Kent or Keitt from Peru is preferred.
- As ingredient of fruit salads. Fruit salads made in restaurants and hotels often contain frozen fruit. In addition, the EU based producers of fresh cut fruit salads sold in supermarkets and convenience stores often switch between frozen fruit and fresh fruit depending on what is cheaper at the moment. This market mainly uses hand-cut chunks. Peru is a big player in this market.

In addition, a small portion of frozen mango is bought by consumers for home usage. The make smoothies or use these as toppings for yoghurt, desserts etc.

We estimate the total sales of frozen Mango in the EU market at 20,000 tons per year, and 45,000 tons in the US markets. The main competitors are Peru, Mexico, China and India, followed by new market entrants Thailand and Vietnam. The average market price fluctuates between \$900 per ton for Ivory from China and Totapuri from India to \$1400 to \$1600 for Kent from Peru and \$2000 for Alphonso. Within the EU the largest importers can be found in The Netherlands and Belgium.

Like mango pulping plants, frozen plants require a large investment of around 3 million USD. Typically, one needs multiple products to make a plant work. The fastest growing product category in frozen foods and vegetables are berries, such as blue berries, black berries, raspberries and strawberries. Morocco is a producer of frozen strawberries. Frozen beans and carrots and broccoli florets also have a stable demand.

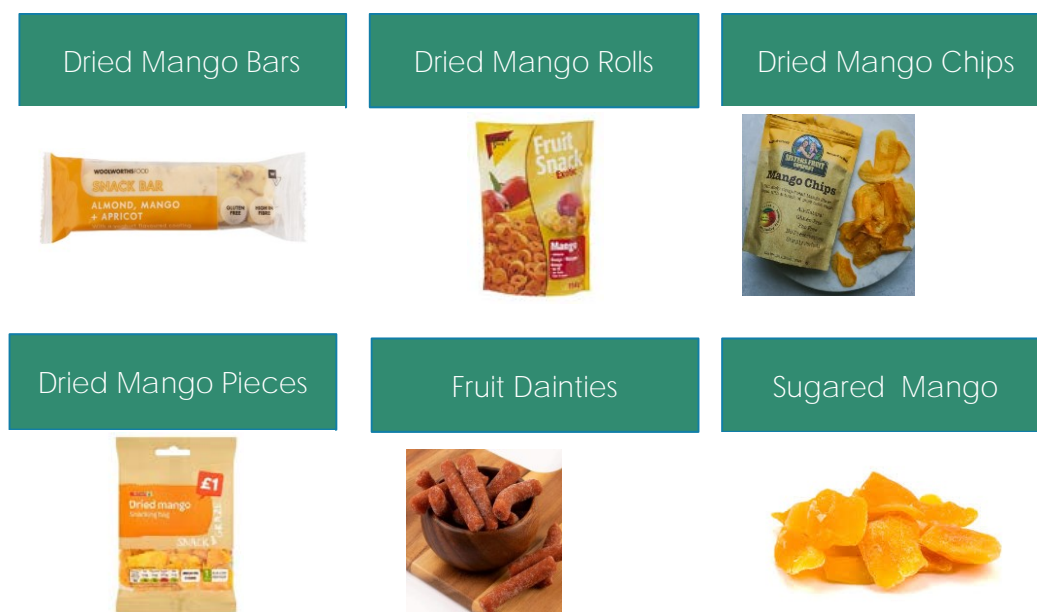
### 3.6.4 Dried Fruit

Dried mango is sold as a healthy snack in the EU and US markets. It is also consumed a lot by children, particularly in lunch boxes at school. Second grade and offcuts are used in small quantities in breakfast cereals. We estimate the market to be around 9000 to 10,000 tons in the EU and 9000 to 13,000 tons in the US. This seems a small amount, but one has to keep in mind that depending on the efficiency of the producer and the variety used, between 10 and 17kg of fresh mango is needed for 1kg of dried mango. Once you add in the labour cost and energy cost it becomes a high value product, priced at about €7500 per ton CNF Rotterdam or \$7500 / ton landed in a warehouse in the US.

Dried mango has been the star of the dried fruit market, traditionally dominated by Mediterranean fruits such as raisins, dates, apricots, peaches, prunes and plums. Growth has been high over the past decades. There is still space for further growth in most of Europe with the exception of the UK, Germany and Switzerland where the market is more developed and better supplied.

There are actually six different types of dried mango product:

Figure 11 Assorted Dried Mango Products



1. Candied or sugared mango produced by placing mango in a sugar solution that draws out the moisture. This product group is still dominated by the Philippines but it's losing relevance overall as consumers increasingly prefer products with no added sugar. One needs access to cheap sugar to be competitive in this segment
2. Dried mango, usually in the form of strips, produced by air drying mango pieces in a special dryer with large fans and electric heaters, gas burners or hot water systems powered by coal, biogas or biomass. This is now the most popular category having shown solid growth. Traditionally dominated by South Africa and Mexico, but with Burkina Faso emerging as a new market leader in the EU.
3. Freeze dried mango, providing a very crisp product with a unique taste sensation is still a very small product group, mainly supplied from China. The production technology is complex and difficult to manage.
4. Dried mango rolls were developed in South Africa as a way to recover waste from overripe mangos and flesh still on the pip. The product has potential to grow but is difficult to manufacture.
5. Dried fruit dainties are made by extruding second and industrial grade dried mango. This product can easily be blended with other types of fruit and delivers a soft product with intense flavour. There is a lot of potential to grow this category in the EU.
6. Dried Mango bars are blends of mango and other fruits with cereals. They can be made using industrial grade dried mango, or with a mango pulp.

For Senegal like the rest of West Africa, dried mango (number 2) offers the best opportunities because it is a growing market where the dominant variety Kent does well. Dried fruit dainties and mango rolls would be important to utilise the expensive mangos properly and so make dried mango production competitive.



For dried fruit production the variety of mango is important. You need a fibreless variety that provides larger mangos (for processing efficiency), has a bright dark yellow or light orange colour when dried, and has sweetness as well as acidity. Some experiences with varieties include:

- Kent and Keitt (South Africa, Ghana, Ivory Coast) are best suited, because they are fibreless and generate great colour and flavour. They are also large mangos allowing for 12 to 14 kg of fresh mango for 1kg of dried mango.
- Brooks from Burkina Faso and Mali provides perhaps the best flavour, but the mangoes are smaller and suffer from fruit fly because it is a late variety.
- Amélie is more fibrous and acidic in flavour, which is actually preferred by about 30% of consumers. Unfortunately, many importers don't like it and think the consumers will not like it. It has been challenging to sell this variety, if it isn't organic.
- Palmer has been tried in Ghana but was not deemed suitable.
- Lippens has been tried in Burkina Faso but misses the acidity to give depth of flavour in the final product.
- There is no experience with Osteen, which has been planted recently as an early variety in Niayes.

Organic makes it easier to sell unknown varieties that are less attractive in flavour and appearance, because there simply is less choice for importers. This is increasingly in demand.

Figure 12 Assorted Organic Dried Mango Packs from the EU



A third distinguishing factor in the dried mango is the difference between conventional, unpreserved and organic mango. Conventional dried mango is usually preserved with sulphur, which helps it to keep its bright yellow-orange colour but also prevents it from drying out. Unpreserved is conventionally farmed mango, but without sulphur added, while organic products is organically farmed unpreserved mango. The challenge is that many consumers want a beautiful product but not the sulphur.

The value chain is relatively simple. Most dried mango is produced in larger factories, that source mango from surrounding plantations. The product is sold to specialised importer-packers who either sell the product in stores and supermarkets under their own brand, or under the retailer brand. There are also a few exporters in Burkina Faso who source dried mango from many smaller factories who are not capable of direct export. In most countries there are larger producers who also source from other smaller producers and thus also act as an exporter- middleman. Most

equipment for processing, including the specialised dryers come from South Africa, which has 3 manufacturers.

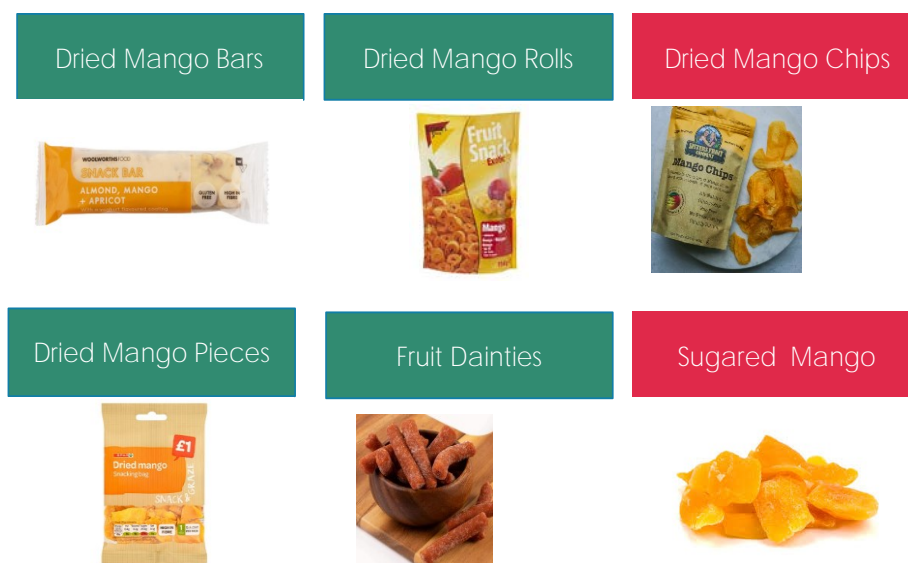
Dried mango is normally packaged in plastic bags of 2.5 kg, in cardboard boxes of 10kg, 22 tons per 40-foot container. Most retail packing is done by the importer, who sometimes uses a contract packer. This is to save on transport cost and being able to change pack sizes and designs on short notice.

The main suppliers to the market are:

- South Africa, the traditional market leader in the EU on conventional dried mango. Production has stagnated due to a lack of mango for processing, and South Africa has lost a lot of market share. Many South African companies are now involved in producing in West Africa.
- Philippines is the traditional market leader in candied mango.
- Mexico is the market leader for the North American market and is slowly trying to get into the EU market.
- Burkina Faso has become the market leader in the EU for both conventional and organic. Exports have increased from 150 tons in 2009 to 3500 tons in 2019 on the back of South African investors.
- Mali has remained a very small player in the sector, still exporting via Burkina Faso. The challenge has been a lack of good management of factories.
- Ghana has been a stable force in the market over the past decade with two large and professional factories producing about 1400 tons. The high prices of mango compared to neighbouring countries make it difficult for other producers to survive and existing ones to grow in Ghana.
- Ivory Coast is an upcoming player, with investments from South Africa and Ghana but still small.
- Ecuador, Kenya and Mozambique all produce very modest volumes sold in the EU.

They mostly use second and third grade mango.

Figure 13 Types of Dried Mango Products and their market potential (green=high potential)

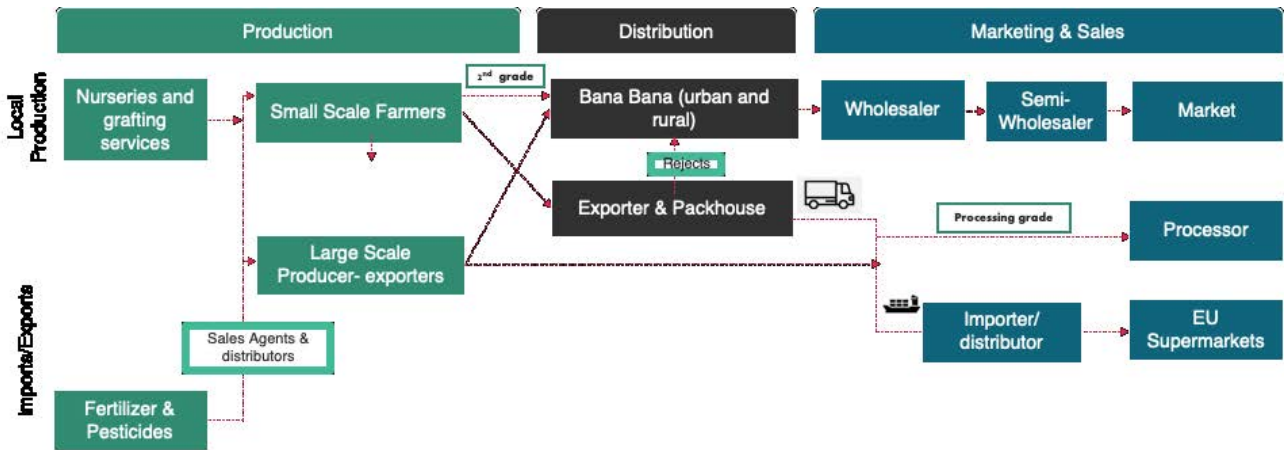


## 4 The Structure of the Value Chain

### 4.1 Overview

The value chain is relatively simple, with large scale producers exporting most of their fruit themselves to the EU importer. Small scale producers do this via an exporter. Second grade is sold to local traders, farmgate and at the packhouse (the sorting rejects). A very small amount goes to processing.

Figure 14 Value Chain Map for Mango in Senegal

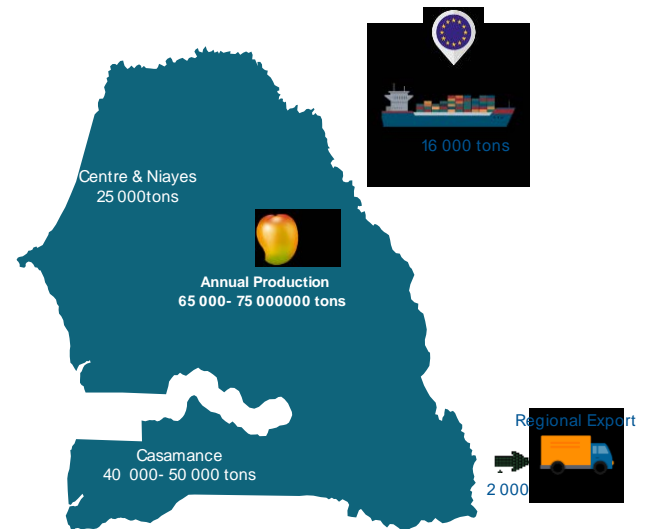


### 4.2 Production Locations

We estimate the total annual production of Mango at 65,000 to 75,000 tons, coming from 3 distinctly different production areas. **The Centre and Niayes** areas produce around 25,000 tons, while the **Casamance** produces around 40,000 to 50,000 tons. Most of the 16,000 tons of fresh exports however come from the Centre and Niayes regions, while a large part of the mango available in the Casamance is not utilised. The **Senegal River Valley** is coming up as a new area, with one orchard established, and one of the largest orchards, Safina, said to move their due to salination of wells.

The main market for producers from the Centre and Niayes is the EU fresh market. Senegalese mango obtains premium prices due to the lack of competition in that marketing window of July till September and is able to provide good quality mangoes.

Figure 15 Map of Production Regions and Volumes



#### 4.2.1 Mango Quality

The quality of mango in the North is high due to low rainfall and thus low disease pressure, a lot of sun and a short transit time. Exporters are only an hour from port and Senegal is close to Europe. Mango can also be transported by road via Morocco to Europe, which increases reliability of



transport & frequency of delivery. Road transport can depart daily. Port shipments weekly. Finally, a large share of the mango marketed from Senegal is sold as Organic. Small farmers tend to produce fruit organically by default. Low rainfall and lower disease pressure makes organic production possible. Furthermore the orchards tend to be isolated, which limits spread of diseases.

Mango quality in the South is lower, because of higher rainfall and limited pest control, and the near continuous spread of fruit trees over the region. Even if a plantation is treated, pest and diseases can easily invade the orchards from nearby trees that are not managed. The region is not only a large mango producer, but also a cashew producer. Mango and cashew trees belong to the same family and therefore suffer from similar pests and diseases. The widespread cashew trees are hosts for mango pests and diseases.

Figure 16 provides the number of producers per region, with indicative production volumes and farm sizes. Over the next paragraphs we will describe the producers in the regions in more detail.

Figure 16 Overview of production regions

	#of Farms	Farm Size	Total Production	Export Volumes	Exporter Traders
Large Plantation	9	50-100ha	25 000	50%-70%	10
Centre Niayes	500-800	1-10 ha (usually 2-3ha)	7 000-10 000 tons per season		
Casamance			40 000-50 000 tons	1 000 tons	

### 4.3 Large plantations in Centre and Niayes

There are about 9 irrigated professional mango orchards from 50 ha to 300 ha in size who export directly from their own packhouses. The total yield is 10-27 tons per ha of which about 50% to 70% is export grade. The planting density in the orchards is 3x6 meter with 500 trees per ha in rows, that are pruned every year and receive a strict schedule of preventative spraying against pests and diseases and also receive fertiliser. The dominant variety is Kent, followed by Keitt. Osteen is just introduced as an early season variety.

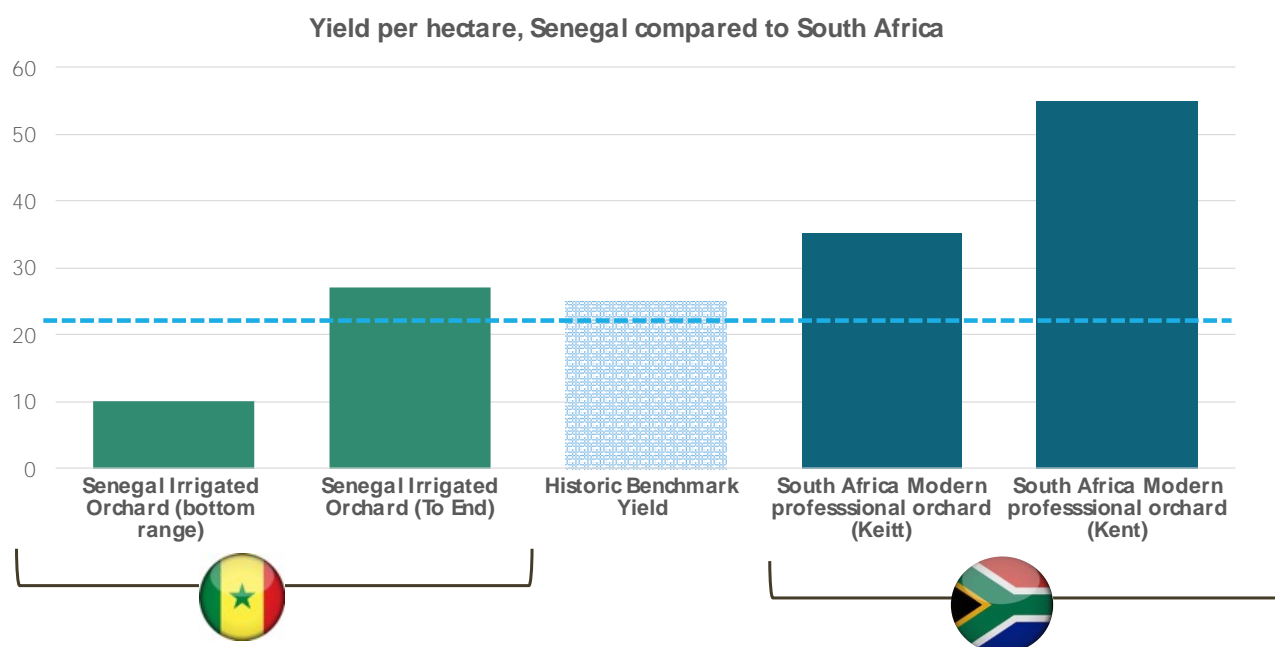
Though for West African standards these are very professional high yielding plantations, there is still a lot of space for improvement. Firstly, several plantations struggle to reach the theoretical yields of 25tons/ ha for Kent, despite large investments in agricultural practices and irrigation.

Secondly, the plantations have converted most of their Keitt to Kent because they struggle with fruit fly once the rains come. However, this is also a matter of proper diseases control. Removing Keitt shortens the season and makes it more difficult to utilise infrastructure such as packhouses properly. Keitt is also a higher yielding variety, though it has larger fruit and thus the export grade is relatively lower.

Thirdly, even the 25 tons per ha is an outdated maximum. For example farms in the Hoedspruit area in South Africa with a comparable climate achieve on average 30 tons for Kent, but the better

ones do 35 tons on Kent, and 35 to 40 tons with a maximum of 45 on Keitt. This is done with a planting density of 1000 to 1500 trees per ha, and even more precise management. For example for each block leaf samples are analysed and a specific fertiliser is developed for that block, that is added to the irrigation system. They still farm Keitt despite the rains.

Figure 17 Comparison of yields between Senegal and South Africa



The difference in yields between Senegal and South Africa can also be caused by differences in genetic material (tree quality). Farms in Senegal tend to produce their own trees, from material selected from their own farms. In South Africa trees are ordered from specialised nurseries.

An issue is that generally boreholes are used for irrigation. The usage of groundwater for irrigation is officially not allowed, and is most likely not sustainable. Pumping from wells that are often more than 100 meters deep also costs a lot of diesel. Salination of boreholes is also an issue.

Commercial plantations in the Niayes area are still expanding, and every couple of years a new plantation is added. But the expansion is modest. Some plantations may move to the Senegal River Valley in future.

#### 4.4 Small Producers in Centre Niayes

We estimate that there are between 500 and 800 small scale farmers in Centre and Niayes that farm between 1 and 10ha each, but on average 2 to 3 ha. We estimate their total production at between 7000 and 10000 tons of mango, of which roughly half is exported. There are 10 exporters-traders who source from these small-scale farms and have their own packhouse. Rejects are sold via informal traders on the local fresh market.

The small farmers can roughly be divided in two categories:

- Owner managed mango farms. For most owners, the mango is one of their farming activities. Green beans, which are planted after the mango season, are often more important for farmers.

- Small plantations owned by formal sector workers in Dakar. These farms have farm managers employed who tend to live on the farm. They tend to be poorly paid and supervised, and are more caretakers than farmers.

The small farms are not irrigated and have a low planting density of around 120 to 160 trees per hectare. Compared to small scale farmers in other countries in West Africa, small scale farmers in Senegal invest a lot in orchard maintenance, and they have a very high percentage of export grade (50% versus 10%).

The trees are pruned annually, which keeps them very small. The orchard floor is cleaned of fallen fruit and weeds annually. The orchards are mostly organic with yields of about 5-8 tons per ha, of which 50% is exportable. Most orchards do use bait traps for fruit fly. These farmers do not use any foliar or chemical fertiliser. At most they may add some manure to each tree and usually not every year. As a result they require only flexible staff – usually 2 workers- who are hired in to carry out specific tasks for short periods throughout the year. Even harvesting is often carried out by the buyer of the fruit.

Nevertheless there is a lot of improvement possible. We believe the plantations would benefit from a higher planting density, investments in soil improvement such as mulching of pruning wood, and keeping a short grass layer instead of barren soils, and supplementary irrigation. Farmers believe higher planting density would require more water which is not available, but we believe that this would reduce the exposure of much of the soil to direct sunlight, which would dramatically reduce evaporation. Furthermore increasing the organic matter would improve the retention of moisture in the soil.

Another issue is the quality of trees used. Most farmers plant trees from seed directly in the orchard and then employ a grafter who comes to the orchard. The rootstock nor grafting wood is certified and standardised, nor is the grafting always done properly. Also not all trees survive the grafting, which leads to open spots.

Some small plantations are slowly being expanded, while others are disappearing due to urbanisation in the greater Dakar area.

#### 4.5 Casamance

**The Casamance** produces about 40,000 to 50,000 tons of fresh mango. Only 1 000 tons from this is allegedly for export via exporters in Dakar. Only one third seems to be traded for the local fresh market in Casamance cities and around Dakar. However, with the Senegambia bridge this is likely to increase. About two thirds is either consumed close to source or not sold because of poor quality (fruit fly infestation, other pests and diseases or overripe), or because it concerns undesirable or unknown varieties for which no market exists.

The region is traditionally divided in 3 areas:

- Basse Casamance in the West, from the coast to Ziguinchor, also referred to as Ziguinchor.
- Moyenne Casamance in the middle, also referred to as Sedhiou.
- Haute Casamance in the East, also referred to as Kolda.

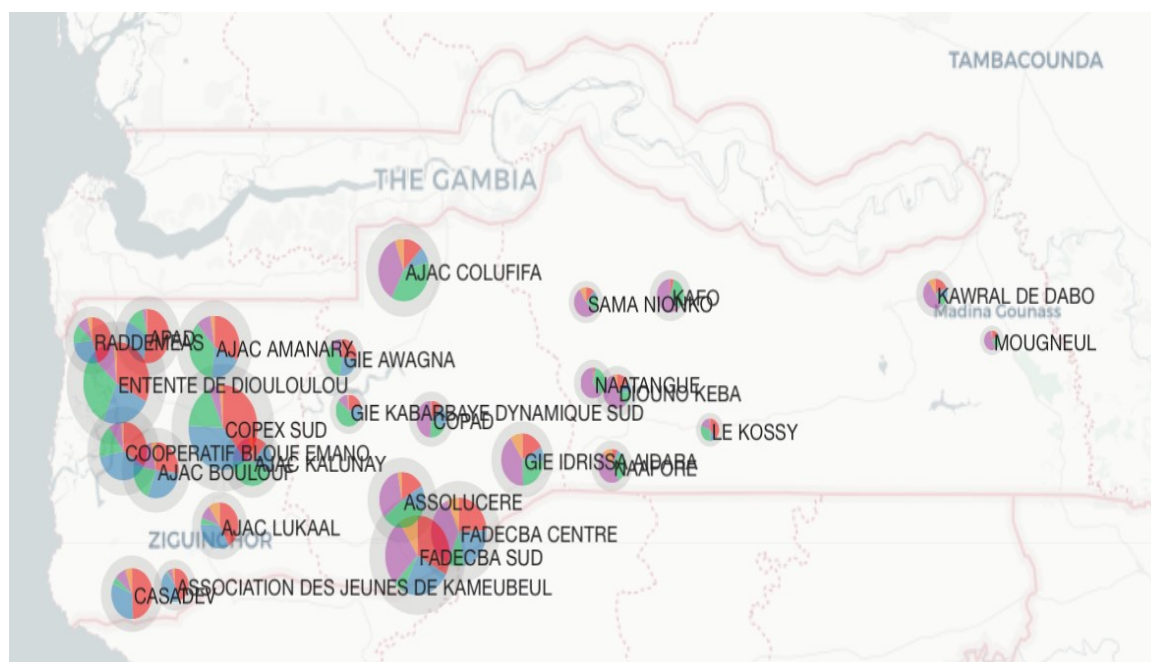
The IFC Comango project has gathered a large amount of statistics over the past years with regards to the number of trees, farmers, plantations and the varieties. Figure 18 shows the number of trees per variety per area, while Figure 19 shows the production zones on the map, with the size of the circle indication the total production and the colours the share per variety.

Comango has recorded 9852 plantations with 414,000 trees. This means an average of only 42 trees per plantation. This is caused on the one hand by the small size of plantations, with many ‘plantations’ actually containing just a few trees, while even ‘proper’ plantations are small. A study in Basse Casamance found that 75% of farms is less than 2 ha, and the average was 1.72 ha. The planting density is also low. The study found that in Basse Casamance 71% of plantations were actually intercropping systems, with crops being farmed in between mango trees. The average tree density was between 30 and 62 trees per ha depending on the area. Even the 31% proper plantations are likely to have a low planting density due to their age. Only 14% is younger than 20 years. At that time 10x10 and 8x8 spacing was the norm, giving 100 to 125 trees per ha. Professional plantations in Centre Niayes work with 500 trees in a 3x6 spacing, whereas in South Africa high yielding plantations use 1000 to 1500 trees per ha.

Figure 18: Break down of production volumes per variety per area in Casamance (Source: comango.org)



Figure 19: Mango Production in the Casamance (source: comango.org)



As such there are 3-4 types of orchards:

1. Semi-professional orchards with about 125 trees per ha that may receive some pruning, spraying and fertilisation. They usually have Kent and Keitt varieties, and a small part of their production may be exported via Dakar. The maximum size is 5ha. There are not so many of these.
2. Small traditional mango orchards that receive no maintenance.
3. Intercrop orchards, which seem to be the majority of orchards.
4. Village orchards and backyard orchards, which just have a limited number of very large trees.

There are at least 35 different varieties of mango in Casamance, but there are 5 main varieties that account for ranging from fibrous to non-fibrous local varieties and grafted Kent and Keith mangoes. Kent and Keitt account for 64% of mango in Ziguinchor, 34% in Sedhiou and 13% in Kolda.

Sierra Leone, Diourou and Papaye are the three other common varieties. Due to COVID 19 we have not been able to taste and inspect those varieties, and thus we do not know if they are suitable for processing, and if so what type of processing and what processing yields can be achieved with them.

Finally, all the other varieties account for 7% and 23% and 32% in the areas respectively. Hence, the further east one goes, the smaller the percentage of Kent and Keitt and the higher the other varieties.

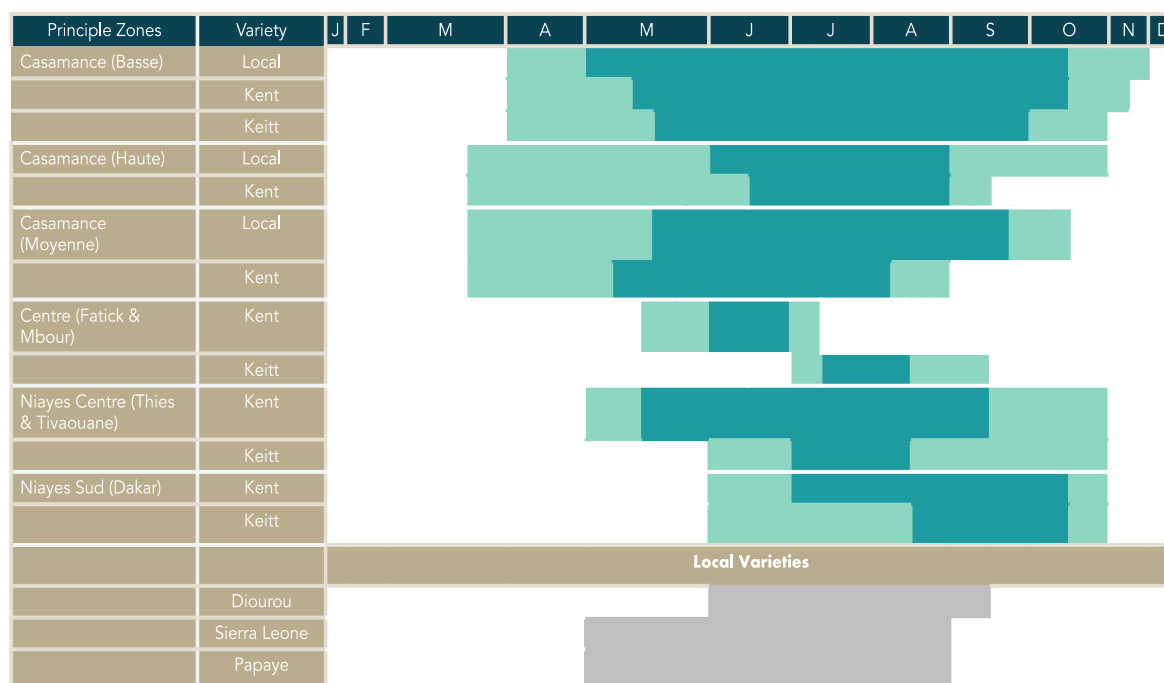
#### 4.6 Mango Production Season

Senegal has a relatively long production season due to the different regions in which mango is produced with their different climates, and the different varieties. Figure 20 provides an overview of the season. The darker shaded areas indicate high season when volumes are higher and prices



lower. The lighter low season areas are not suitable for processors because mango will be too expensive. The season lasts basically 6 months.

Figure 20: Production Season for various Mango Varieties in Senegal



## 4.7 Processing

### 4.7.1 Mango Puree and Juice

Between 2015 and 2017 Aggrofruits, part of beverage company Kirène purchased between 1000 and 3500 tons per annum to produce mango puree for usage in their own Presseas and Minute Maid juices and for export. But it struggled to source enough mango at economic prices and export the juice produced that could not be absorbed in the own factory. Making the plant economically feasible requires it to process at least 5000 tons of fresh mango per year, and export most of the 3000 tons of puree produced.

On the sales side, Kirène struggled. They invested in Coca Cola certification, but the company never honoured their promises of buying the puree. The company had no experience in business to business marketing. Finally, the company struggled to sell the product at a higher price than the cheaper Totapuri from India. Though one would expect the Kent and Keitt from Senegal - high in sugar - to be a better product, it is unclear whether it can actually fetch a premium. And in the Centre and Niayes region it is not possible to purchase mango at a price that will allow it to compete with India.

A big issue is that small producers in Centre and Niayes have no interest in selling to processors who cannot match the price for non-export grade on the local fresh market, which is often more than 200 FCFA/kg. Export orchards on the other hand are interested in selling their rejects to large processors, instead of dealing with too many individual, often unreliable traders. Kirène sourced mango at 125 FCFA/kg for conventional and 150 FCFA/kg for organic, but even at this price that is considerably lower than the local fresh market, it cannot compete with India. Furthermore, at these prices it cannot secure the 5000 tons in Centre and Niayes it needs to break even.



Making the plant profitable would require the business to source large amounts of mango in Mali and Casamance, which would increase volumes and bring down the average price per kg. It would also lengthen the season to at least 5 months, which would make it competitive. However, this would require an investment in supply chain development including trucks and sorting warehouses, which Kirène was not willing to make.

Agrofruits stopped production and is now thinking about moving the line to Casamance or Ivory Coast. It does not seem to make sense to base an industrial juice line around Dakar.

Agrofruits stopped production and is now thinking about moving the line to Casamance or Ivory Coast. It does not seem to make sense to base an industrial juice line around Dakar.

#### 4.7.2 Other Processing

There are a handful of other mango processors, including about 2 drying factories around Dakar but they never reached any serious production volumes despite some of them having acquired professional drying equipment from South Africa. Fruit prices are simply too high to be competitive for a small start-up company.

Finally, Blue Skies exports fresh export rejects from Senegal to Ghana by air. These are cut for the EU fresh fruit salad market. Given the number of flights between Senegal and the EU it would make sense to export directly from Senegal to the EU, and this could be an opportunity to be explored post Covid.

### 4.8 Pricing in the Value Chain

Small farmers receive between 275 and 350 CFA farm gate for export grade, but on average closer to 300 CFA. By the time this is sorted, washed and packed in boxes in refrigerated containers and on the ship the price is 800CFA. This seems a large margin, but about 10% of mangos are still rejected at the packhouse level. Packaging has high labour cost and packaging cost, and transport to the ship also needs to be added. Senegal does receive a higher than usual FOB price for mango due to quality and less competition in this window.

Farmers are still able to sell second grade mango to local bana-banas for very high prices between 175 to 225 CFA. When the mango puree plant was operational, they purchased for 125CFA for conventional and 150CFA for organic mango. This price was not interesting for small scalars who only need one or two bana-banas to sell their crop. It is only the large plantations who do not want to deal with many traders every single day who are interested in selling this price, which is still high in the region for processors.

Figure 21 Prices in the mango value chain in Centre and Niayes

	Export	Local	Industrial processing
Farm Gate	275 – 350 FCFA	175- 225FCFA	125/ 150 FCFA
Exporter/ packhouse FOB	800 FCFA	800 FCFA	

Pricing in Casamance is much less transparent. Roadside prices at which mangos are sold vary between 25 and 50CFA/ kg depending on location, variety and season. This is however the price paid to a trader harvester. A series of traders is involved before the mango arrives in Dakar. It could be that with the new bridge transport cost are lower and higher farm gate prices are possible. However, competition between farmers and traders is high, so farmers do not have a good bargaining position.

## 4.9 Actors in the Value Chain

### 4.9.1 Direct Actors

Figure 14 provides an overview of the value chain. In Centre and Niayes, small scale producers sell export grade to exporters, some of which are cooperatives, some are larger farms and some specialised exporters without a farm. The exporters sell to importers in the EU, who in turn sell to retailers and supermarkets. Commercial plantations export directly to the EU.

Non-export grade is sold to small traders who in turn supply retailers, mostly in Dakar. Processors when active source rejects from packhouses at large plantations and those servicing small farmers. Some traders also come to the packhouses for rejects.

In the Casamance the value chain is longer and more complicated. There are harvester traders who negotiate a price with owners, harvest the mango with their team and then sell the mango onwards to traders who transport it to urban market. Mango is also harvested by households themselves and other people and sold on the roadside to consumers and other traders who in turn transport this to major towns.

### 4.9.2 Indirect Actors

There are only a few nurseries supplying to farmers, and those are not very professional. There are no specialised maintenance service providers, only independent grafters who are paid per tree by farmers and nurseries.

### 4.9.3 Professional Organisations

Professional organisations are a common feature of the agricultural sector. However, there are relatively few in the mango sector that are fully operational.

The mango "interprofession" is intended to support producers to lobby for additional support and develop technical skills, access to market etc. It's supported by USAID, but isn't fully operational.

Market access is a key issue that's being addresses by a PPD working platform. Its goal is to increase the access of local producers to the EU and to ensure that fruit fly is controlled so that this access isn't jeopardised. In the Casamance various producer associations are involved in initiatives that relate to fruit fly control especially.

### 4.9.4 Banks and Microfinance Organisations

Larger mango farmers are able to access financing (working capital and asset finance) through the La Banque Agricole (formerly **CNCAS**). Most small-scale farmers who are not able to self-finance, get financing elsewhere. Where they are interested in pursuing financing from the banking system, they tend to turn to micro-finance organisations. PAMECAS, the Union Financiers Mutualiste are some of the MFI's extending loan products to small scale farmers. These institutions offer unsecured lending, at 16% interest per year with a payback period of 3 years for



investments in equipment or working capital for inputs. The MFI's are also able to access funding from the Priority Investment Guarantee Fund (FONGIP).

#### 4.9.5 Input Supplier Financing

Solar pump irrigation for small scale producers is in part pre-financed by suppliers. They provide zero interest financing to MFI's, who then offer loans to small scale producers. These loans are typically attract a 16% interest rate and are paid off over a 3 year period. MFI's have become more adept at providing financing and business planning advice. This ensures that the farmers take out loans for optimal amounts so that they get the required returns to be able to pay back these loans. The MFI's are also far more adept at managing their default rates. So they play an important role in small scale finance.

#### 4.9.6 Agricultural Insurance in Senegal

There aren't any specific agricultural products specifically crafted for mango producers. In fact, agricultural insurance has only recently been developed in Senegal. Most of the focus to date has been on the grain chains. Nevertheless, the National Agricultural Insurance Company of Senegal has been working to offer insurance products in all agricultural sectors with the exception of livestock and fishing. Risks of crop failure due to flooding or (index insurance), to damage caused by birds, wildlife, etc. are some areas that are covered. However, uptake of these products is still low.

#### 4.9.7 The Knowledge Sector

Knowledge and skills development are two important supporting activities in the agricultural sector. A sound structure would have a good combination of proactive research and development, which is then enriched and disseminated to professional education, vocational training and extension services. Despite mango being an important export product for Senegal, it doesn't get much specific attention from a knowledge development perspective. As a result the general agricultural knowledge system applies.

Some practical skills are being developed with the assistance of exporters and donors. But this is fairly limited to fruit fly control. As a result, much of the general framework for research and development and extension services is described below.

#### 4.9.8 Research and Development & Professional Skills development

Agricultural research and development falls under the remit of the Senegal Institute of Agricultural Research (ISRA). It falls under the Ministry of Agriculture and Rural Equipment's (MAER) but operates as an autonomous unit. The Institute of Food Technology and the Universities of Dakar, Thiès, Saint Louis and Ziguinchor all contribute to knowledge development in the agricultural sector. But there's relatively little work being done to improve techniques for mango farming or tree development.

Generally, international research teams provide additional resources for Senegal. For example, the Institute for Research on Development in France provides funding for students carrying out research in developing countries. Their local partner IRD- Senegal focusses on environmental sustainability amongst other themes.

#### 4.9.9 Extension Services

Some mango exporters provide some support to the small scale farmers they work with. This is especially linked to phytosanitary controls. Some producer associations in the Casamance have

been working on fruit fly control. But the structure of production in that area make this a tricky model.

All other extension services are linked to the state system. While there are not very active in mango, the system is outlined below as it could provide insights in to the potential partners who could be engaged for a project around extension services.

Extension Services are designed to be coordinated and developed by **ANCAR**. This state funded agency has extension staff in each of Senegal's 45 districts and 190 counties. However, a chronic shortage of funds means that there's been a high vacancy rate in the organisation since 2017. To support ANCAR, Special Regional Development Agencies (**SRDR's**) were established by the government. They operate in particular zones and on particular themes. For example, the Senegal River Development Agency (**SAED**) was created in in the Senegal River Valley to support the development of irrigated agriculture there. The Agency's advisory service employs 85 field extension staff equipped with motorbikes and 12 supervisors. Extension activities include participatory diagnosis, needs assessment, implementing activities and monitoring and evaluation. SAED receives funding from the government and is currently managing seven donor- financed projects funded by the African Development Bank, the French Development Agency, the Japanese International Cooperation Agency, the Korea International Cooperation Agency, the Kuwait Fund, the Saudi Fund for Development and the World Bank.

Another relevant agency is **ANIDA**. Founded in 2006, the National Agency for Agricultural is tasked with creating large, modern farms in "community agricultural domains," primarily to serve as employment opportunities for rural youth and to promote agricultural development. Twelve such domains are in operation and include over 100 farms. ANIDA employs 70 extension agents, who are supervised by 12 extension managers. Donors include the African Development Bank and the governments of Senegal, Spain and Brazil. In addition to extension services, these organizations provide a range of support including infrastructural development and supply of inputs.

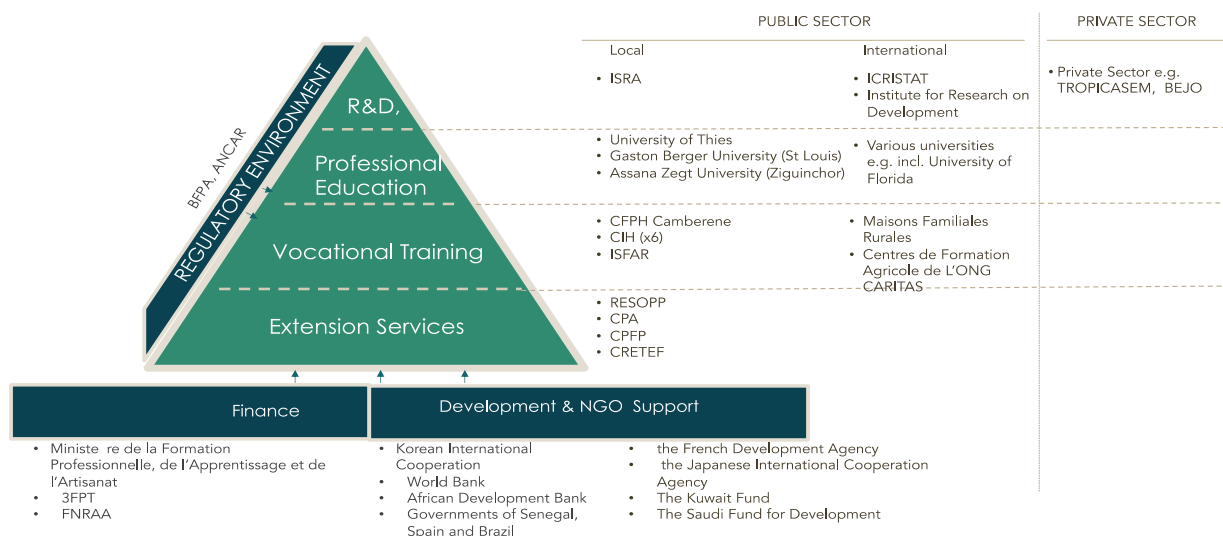
Some professional and cooperative organisations provide training for their members. For example, RESOPP. This is a federation of farmer cooperatives, which offers training services to its member cooperatives as well as non-members. To realise this goal, they have training facilities in 8 out of the 15 regions in which Senegal is divided.

The Centre Polyvalents de Formation des Producteurs (**CPFP**) and the Centres Régionaux de Formation Technique et Professionnelle, (**CRETEF**) provide training on agricultural techniques and innovative techniques for farming amongst other topics. These are targeted at producers.

The small scale of production and especially commercial enterprise related to these specific vegetables suggests that this is a small and relatively unimportant activity area for these extension services providers. However, should outgrower schemes become popular as a mode, local shoppers begin to look for these vegetables more often, or this be seen as a means to develop a more varied diet in Senegal, then this will need to be rectified.



Figure 22 Overview Of Knowledge And Skills Development Actors In Senegal



#### 4.9.10 Finance (Agricultural Knowledge Sector)

The system design has created clarity on the intended financing mechanism for R&D. This should be funded by the National Agro-Food Research Fund of Senegal. This is a government agency established in 2004 that mostly funds research but has recently started funding dissemination of knowledge. The National Fund for Agro-Sylvo Pastoral Development (FNDASP) provides funding to support for the dissemination and large-scale adoption of technologies. They also fund projects that will expand the availability of certified seeds for priority sectors by promoting sustainable seed systems.

These are not specifically targeted at mango. Also resource constraints mean that these funds are fairly limited.

### 5 Issues and opportunities

#### 5.1 Space to expand fresh exports to the EU

The market for fresh mango is still growing in the EU, and Senegal is well positioned to grow. The mango from Senegal is well appreciated by consumers and importers for its flavour. Importers appreciate the professionalism of the exporters, particularly those with their own plantations. The quality is high because the plantations are only an hour from port, and the boats go directly to Europe in 6 days. This provides longer shelf life, or more flavour because mangos can also be harvested later when more mature. There is also the alternative of being able to transport mango by road to Spain. Finally, Senegal has a unique time window on the market where competition is still limited (see figure 2).

Despite all these advantages, the export from Senegal to the EU is still relatively small with about 15,000 tons over 3 months. In comparison, Ivory Coast exports 30,000 to 35,000 tons over a 6-week period. Compared to that peak in the market there is still space for another 10,000 to 15000 tons from Senegal, particularly in the late season when Niayes is usually harvesting. We see a continued modest expansion of plantations with a new player coming in roughly every 2-3 years, and existing plantations gradually expanding. There is however potential to accelerate this pace. One way would be to focus more on productivity increases of both commercial and small holder farmers.



An expansion of production would also increase the supply for second grade mango for processors and the local market, potentially lowering the prices for processing grade and making that activity more profitable.

The Senegal River Valley is actually the best placed for expansion of mango production, because it would fit in the later window and has a sustainable source of irrigation. There is also space for small scale producers in Casamance and Centre and Niayes to fit into these value chains if they further professionalise.

Another opportunity for expansion is the introduction of an early season variety like Osteen. A few plantations have planted test plots. It is a variety that is well appreciated on the EU market, and if it performs well it makes sense to plant this on a larger scale.

## 5.2 Low Productivity of Orchards And Unsustainable Water Sources

The majority of Senegalese commercial plantations are still yielding way below their potential, with some sitting at 15 tons, while the best one yield 25 tons. Major gains are possible by introducing precision farming, consultation from experts and higher density orchards. Small scale orchards particularly should be able to achieve productivity gains by better soil and water management and increasing the density, as well as fertilisation.

A key issue is the source of water for irrigation. Most plantations pump groundwater from boreholes, which may lower the water table, plus the emissions and cost of diesel are high. It is important to look at how this can be made more sustainable. Solar irrigation has been used in many African countries and multiple locations in Senegal to expand access to irrigation. This is affordable technology, with low requirements for technical skill and is especially well suited to small scale producers. Salinisation of boreholes is also an issue that needs to be tackled. This requires better water and land management, more rigorous implementation of existing policy around water-use from boreholes and the development of new more precise techniques to minimise water use.

This has been the topic of intervention for a few donor agencies. However, the causes of salinisation and solutions are fairly area specific. Salinity levels in Saint Louis is different than in Podor or in the Centre Niayes. The solutions along the Senegal River Valley would also be different in Podor than in borehole fed irrigation amongst small scalers in the Centre Niayes. As a result, there is still much to be won.

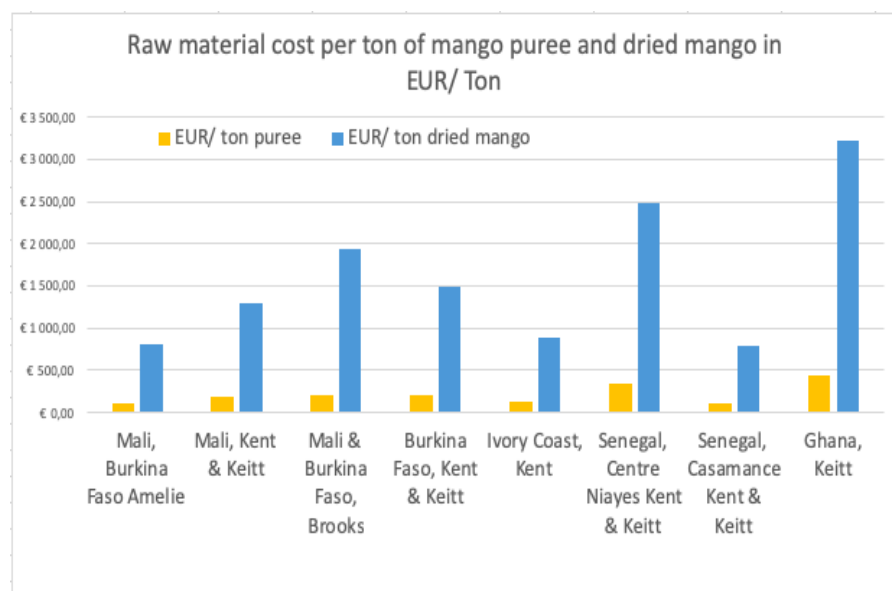
## 5.3 Lack Of A Competitive Processing Sector

There are currently no professional processors in Senegal with a significant production and export volume. The main reason is that processing in Centre Niayes is not competitive, because there is too little 'processing grade' mango available and the prices are too high. High prices are in turn caused by the lack of supply and the strong domestic demand.

At the current processing grade price of 125 FCFA/kg, processors cannot compete with the fresh market who is willing to pay 225 FCFA/kg farmgate. And even 125 FCFA is still too high for juice, IQF and Mango-puree to be competitive. In comparison, the farm gate price for Kent in Ivory Coast is 30 to 50 FCFA, 70-80 FCFA in Burkina Faso and about 60 FCFA in Mali. Amélie in Mali is as low as

30 FCFA/kg. Because 1.72 kg of fresh mango is needed for 1 kg of mango puree, and 13 kg for 1 kg of dried mango, this price difference is further amplified. Figure 23 compares the cost per ton of puree and ton of dried mango of different varieties across West Africa.

Figure 23 Comparative Cost of Mango Puree vs Dried Mango



From this figure it becomes clear that only Ghana has higher prices. Interestingly, both Ghana and Senegal do not export mango puree currently, while Burkina Faso and Mali have one and two exporting plants each.

Ghana exports around 1400 tons of dried mango coming from 2 plants, but the only reason this is economically feasible is that these are very efficiently run factories that have been established a long time ago, and that they can utilise their equipment for a large part of the year by drying pineapple and coconut. This is an option that Senegal does not have. Furthermore, one has to take into consideration that over the past decade there has not been a single new export drying plant in Ghana. Whereas Ivory Coast and Burkina have had many new plants.

Furthermore, we have seen across West Africa that establishing a successful processing plant for export requires a strategic partnership and investment from either importers or established processors from other countries. Those partners are more likely to invest in Ivory Coast, Mali or Burkina Faso at the moment. For example, Sense and IFC convinced Westfalia-Mpak (market leaders in dried mango with large plant in South Africa and Burkina Faso) to visit Senegal for a scoping mission, but they decided to invest in Mali instead.

A significant expansion of the fresh mango export could however result in an increased supply for processing and drive down prices in the future.

#### 5.4 Challenging roadmap for Fresh exports from the Casamance

Casamance does have much more mango and at a significantly lower price than Centre-Niayes zone. The informal, disorganised structure of production has made it difficult for this region to win share of the export market. Firstly, logistics need to be improved so that the mango can be harvested, collected and readied for road or sea freight to Dakar. This is not a small task as farmer. A “producer” might be a resident with a single mango tree in their yard.



The commercial aspect of this collection will need to be better organised, with collectors brought into the chain in a coherent way. They will need financing for tricycles, packaging crates, working capital etc.

Another important barrier to tackle would be fruit fly and phytosanitary control. This is challenging in modern organised orchards. But it will be more difficult in Casamance, which has a more humid climate than Centre Niayes. Farmers use a zero-input model of production, which raises the question of whether they can be convinced to participate in a program to control phytosanitary pressure.

Finally, marketing mangoes from Casamance is made more difficult because buyers are often unsure of whether the mango they're buying meets the agreed quality standards. At the moment they travel to the region to check quality. But this is not sustainable and erodes some of the cost advantage of sourcing from this area. Finding a mechanism to reduce this uncertainty would be beneficial. Vertical integration with an exporter or producer in the Centre Niayes would be helpful, but there's a difficult case to be made when compared to investing in the Senegal River Valley. An intermediate stage packhouse that grades mangoes and arranges outbound logistics could be considered. But again, the business case for a commercial investor could be tricky when compared to investing elsewhere in Senegal.

### 5.5 Processing in Casamance

The processing opportunity in the Casamance is by comparison far more straightforward than for fresh market exports. There is a fair amount of Kent and Keitt at affordable prices. Furthermore, there are other varieties, Diourou, Sierra Leone and Papaye, that may or may not be suitable for drying, juice or freezing. What they are suitable for will require explorative production trials. These can assess how they perform when compared to better-known processing varieties like Kent, Totapuri, Amelie etc.

Setting up processing in Casamance will require significant investments in post-harvest logistics in order to secure a steady supply. In the current system orchards are so small and the value chain is so fragmented that it will be challenging to get a consistent stream of mango to a plant. It may require a plant to set-up decentralised collection hubs and invest in crates, trucks and picking teams. This is not impossible, various juice plants in Mali and Burkina Faso have gone the same route. There are also initiatives from donor agencies currently working to map these varieties, organise farmers and improve logistics. However, there is a lot of work to be done.

The most important benefit is that the phytosanitary challenges are lower for processed mango. The region could also offer organic by default product, which achieves higher prices. Buyers of organic product are also more open to new suppliers and are more forgiving of poorer quality. Developing the processing sector here allows the producers to benefit from a natural competitive advantage- rather than aiming for a market that is very profitable, but potentially difficult to win in, with greater risk. It allows the actors in the chain to organise & potentially find solutions for improving phytosanitary control. These can be used in future initiatives to expand fresh mango exports. Processing could thus be a stepping-stone to developing competitiveness for is a lower risk roadmap to being able to compete in the fresh export market at a later stage. The development impact could be significant. Stimulating mango drying in the Casamance could

provide hundreds of jobs for women in factories as well as impact thousands of families/small scale farmers.

### 5.6 Genetic Material & Nurseries

There seem to be no professional nurseries in Casamance. Both commercial and small-scale farms would benefit from professional nurseries that can provide high quality trees. This is an activity that requires limited investments and can provide employment to youth and women. It is typically a small-scale production model that requires relatively small plots of land. The infrastructure required is also relatively small. But it does require precision farming techniques and good control of production & marketing so that “fakes” are not allowed to creep in to the system. Working to improve genetics so that the trees are naturally high yielding clones as system-wide benefits that can be reaped for decades.

### 5.7 Long Earn Back-Period for Investments

Because investments in a new orchard and packhouse are substantial and it takes 4 years from planting decent size grafted trees to a first sizable crop, it takes 8 years to earn back the investment. This is a long timeframe for any investment, particularly in Africa.

### 5.8 Diversification: Opportunity and Need

It is very challenging to run a profitable mango orchard with export packhouse if you only use the packhouse for mango. It is not without a reason that several plantations, e.g., Safina, van Oers and Soleil Verte, combine mango with green beans. The seasons are complimentary, allowing the same packhouse and trained staff to be used for a longer period. The other advantage is also that green beans are an annual crop that can provide cash flow and income while a mango plantation is still in development. It also spreads the risk and helps to make more efficient use of permanent staff.

It makes sense to also explore other diversification opportunities that would utilise the packhouse, for example sweet melons, sweet corn and strawberries for export, or premium packaged vegetables for supermarkets in Dakar.

### 5.9 Orchard Maintenance Services

One way to improve productivity of small-scale farms is to stimulate the development of orchard maintenance services. In addition to knowledge, proper maintenance often does not happen due to a lack of labour and equipment. Professional orchard maintenance services are private businesses who employ teams of skilled workers led by a trained agronomist who perform services such as pruning, fertilisation, pest and diseases scouting, preventative spraying and treatment etc. The teams have professional equipment such as mist-blowers, chainsaws, pole-pruners, wood chippers and brushcutters. With the support of the HortiFresh program these services are currently being developed in Ghana and Ivory Coast.

This activity seems to be a good opportunity for youth employment. From a development program perspective, it's cheaper to train and equip 100 professionals than 2000 farmers.

## 5.10 Solar Irrigation

Irrigation is essential in Senegal. Yet, the use of diesel to power pumps means that the cost of irrigation is high. Solar powered irrigation is being used in vegetable crops amongst small scale producers. This creates potential to adopt these systems for commercial mango orchards. Where large commercial open field crops are limited in the adoption of this technology by the large scale of their operations, mango orchards are generally more compact. Drip irrigation fed from water harvesting tanks that are in turn are fed by solar powered pumps is thus possible- especially along the Senegal River Valley where farmers are close to the river. Professional service providers already exist.

## 6 Environmental Sustainability (Circular Economy)

### 6.1 Water Usage

There are limited environmental issues with the mostly organic small scale producers in Centre and Niayes as well as Casamance. The bigger issue is with the commercial plantations in centre and Niayes because they use groundwater for irrigation, which may not be sustainable. However, at least this water is used for a high end export crop as opposed to for example onions and potatoes. Furthermore because water is used for a permanent crop soil salinations are limited. Water usage is also lower because irrigation is precise with driplines at the base of the trees. There is less surface evaporation because watering takes place in the shade of the tree.

### 6.2 Pesticide Usage

Commercial farmers use pesticides and fungicides to control pests and diseases. However, compared again to potatoes and onions the environmental impact is less. Firstly all chemicals used need to meet strict EU requirements, and therefor there is limited use of forbidden pesticides. Maximum allowed pesticide residues also mean that usage needs to be limited. A lot of the fertilisation takes place with foliage fertiliser, which means run off of fertiliser to streams and leaching into ground water is also more limited.

### 6.3 Energy Usage

Transport by refrigerated containers uses a lot of energy, but the transport and transit times are shorter compared to other suppliers to the EU. Transport to road via Morocco to Spain does have high carbon emissions.

## 7 Socio-Economic Development (food security, employment, women and youth)

### 7.1 Livelihoods

For small scale farmers mango production is often just one of several activities or crops, and one that does not require high investments in terms of inputs, labour and time. Mango is usually not their primary crop. Often farmers will interplant with cash crops such as legumes, okra, eggplants and chilli-peppers, and mango revenues are reinvested in these crops that offer quicker returns.

Nevertheless, it is a very financially attractive business. Figure 23 contains a profit and loss statement of a small scale mango farmer in Les Niayes with 1,8 ha producing 5,25 tons/ha. 50% is

sold to exporters at € 0,45/kg and 50% to local market traders at €0,23. With very few inputs used, gross margins are 92% and net margins before tax are 74% representing a very healthy € 1314 /ha.

Figure 24 Profit and loss for small farmers in Senegal

Profit and loss								
REVENUES		tons	price/kg	Revenue per Ha	Per Kg	TOTAL FARM		
Grade 1		2,625	0,45 *	1 181	0,225	2 126		
Grade 2		2,625	0,225 *	591	0,1125	1 063		
Grade 3		0	0	-	0	-		
<b>TOTAL REVENUES</b>				<b>1 772</b>	<b>0,3375</b>	<b>3 189</b>		
VARIABLE COST								
Variable Cost: inputs		Unit	Cost/ Unit	No. Units per ha	Months	Cost/ ha	Per Kg	TOTAL FARM
Foliage fertiliser	kg	18	1	3		18	0,003	32
Fruitfly spray	Kg	12	1,00	1		12	0,002	22
<b>SUB TOTAL: INPUTS</b>						<b>30</b>	<b>0,006</b>	<b>54</b>
Variable Cost: labour		Unit	Cost/ Unit	No. Units per ha	Months	Cost/ ha	Per Kg	TOTAL FARM
Pruning	working day/ year	37,5	1	2		37,5	0,00714286	68
Spraying	working day/ year	15	1	2		15	0,00285714	27
weeding	working day/ year	15	1	1		15	0,00285714	27
removing fallen fruit	working day/ year	7,5	2	3		15	0,00285714	27
fence maintenance	working day/ year	15	2			30	0,00571429	54
<b>SUB TOTAL: INPUTS</b>						<b>113</b>	<b>0,02</b>	<b>203</b>
<b>TOTAL VARIABLE COST</b>						<b>143</b>	<b>0,03</b>	<b>257</b>
<b>GROSS MARGIN</b>		<b>92%</b>				<b>1 629</b>	<b>0,31</b>	<b>2 933</b>
FIXED COST for the entire orchard								
Fixed staff		No. of staff	Salary/mont	no. months	total cost	Cost/ ha		
Workers		2	15	3	90	50	0,01	90
<b>SUB TOTAL FIXED STAFF</b>						<b>50</b>	<b>0,01</b>	<b>90</b>
Other fixed cost								
	% of capex	capex						
Insurance	0%	2 625				-	-	-
Maintenance	0%	2 625				-	-	-
Depreciation		278				-	-	-
Working capital interest						-	-	-
Phone cost					108	60	0,01	108
Fuel/Water					108	60	0,01	108
Certification					-	-	-	-
Electricity					198	-	-	-
travel					263	146	0,03	263
<b>TOTAL FIXED COSTS</b>					<b>198</b>	<b>316</b>	<b>0,06</b>	<b>569</b>
<b>PROFIT BEFORE TAX</b>		<b>74%</b>				<b>1 314</b>	<b>0,25</b>	<b>2 364</b>

The situation in Casamance is different, for a number of reasons:

- They mostly lack access to the lucrative export market.
- They fetch far lower prices on the local market, because there is much more supply and it requires multiple traders and a longer transport route crossing borders to reach the Dakar market.
- The planting density is far lower for most farmers because they have mango trees in an open field as opposed to some horticultural crops in-between the mango trees. Yield per ha are much lower.

This means that for Casamance, Mango is even more of a side income for which no real investments are made. Most farmers do not prune or fertilise or spray. They don't typically invest in labour & so rely on family labour. It is simply a bonus income, that comes at a time when farmers have limited other income, ahead of the planting of the major crop when the rains start. It also acts as a diversification strategy providing an alternative source of income.

Commercial plantations on the other hand are a labour intensive business, requiring treatment throughout the year, plus casual labour during the harvest and pruning after the harvest. A 100ha plantation would have 10 permanent employees, 10 workers during the season in the packhouse and another 90 people harvesting.

## 7.2 Food security

Food security- and developing some degree of self-sufficiency- is a particularly pressing theme in Senegal. Fruit is an important part of a healthy diet, and there are few fruits produced in Senegal. It is pretty much limited to Mango, some banana and water melons, as well as sweet melons for export. From this perspective having local production of fruit decreases imports and has a positive impact on health.

## 7.3 Inclusive Development

Mango farming in Senegal is mostly limited to men. Establishing an orchard requires secure land rights and an up-front investment which usually places it outside the possibilities of women. Nevertheless experience suggest women are usually better in managing horticultural crops. Fruit farming is also an activity that often attracts a younger crowd keen to set up professional orchards, even if they need to start out small. There is thus a challenge in looking into how youth and women can access land to establish orchards.

Professional orchards as well as extension services to smaller farmers, professional nurseries, orchard maintenance services and sale and servicing of small scale irrigation systems are all activities that are of interest to youth. They are more modern technology driven activities that can be grown gradually and do not require large investments up front.

Women are involved in retail of mangoes, but not so much in trading (bana banas). In other West African countries mango processing is the domain of women, with usually about 50% of entrepreneurs and over 90% of the factory staff being women. Hence developing this activity in Senegal and particularly Casamance would offer great opportunities for women.

Women tend to be over-represented in the more detail-oriented activities in packhouses. This bodes well for their ability to find employment. This is reflected in the employment statistics shared by industrial fruit and vegetable growers. At Grand Domaine du Senegal (GDS) 22% of their staff is female. Van Oers, employs more than 4000 women during the harvest period. Furthermore, this is an area where women are generally not in competition with men. Industrial production is this a meaningful way to create better inclusivity of women in the workforce.

## 8 Options for Intervention

### 8.1 SWOT Analysis

#### Strengths:

- Unique export window for EU
- Close to EU market
- Good climate for mango
- Presence of professional plantations
- Relatively advanced small scale farmers

#### Weaknesses:

- High price of mango, in particular export grade
- Low yields per ha for commercial plantations compared to peers
- No professional processing sector
- Domestic trade poorly organised
- Largest production region, Casamance, is poorly connected to the market
- Domestic trade is not well organised

	<ul style="list-style-type: none"> <li>– Dependent on groundwater from boreholes, high cost of pumping</li> <li>– Production of trees is not professionalised</li> <li>– Fresh export is very dependent on one variety, Kent</li> </ul>
<p><b>Opportunities:</b></p> <ul style="list-style-type: none"> <li>– Exports can be doubled: space in the market</li> <li>– Expansion of orchards in Senegal River Valley</li> <li>– Processing in Casamance if varieties are suitable</li> <li>– Space for women and youth in services of small scale farmers and nurseries</li> <li>– Solar irrigation</li> <li>– Lengthening the season with new variety Osteen</li> </ul>	<p><b>Threats:</b></p> <ul style="list-style-type: none"> <li>– Unsustainable use of groundwater</li> <li>– Urbanisation is taking productive land out of the mango zone</li> <li>– Fruit fly and other diseases make Keitt less feasible</li> </ul>

## 8.2 Bottlenecks & Interventions

Bottlenecks	#	Interventions	Fit with Dutch Knowledge, Strategic interests etc.	SDG Goals
Space to expand fresh exports to the EU.	1	Support investment in orchard expansion in existing and new production areas. (investment promotion, access to finance, technical proficiency and market linkages with the NL and other EU countries.	****	1,2,8
A yield gap with major exporting countries & unsustainable water usage.	2a	Support knowledge development in the mango sector that focusses on yield improvements and sustainable practices. This includes introducing precision farming techniques, water management, enhancing knowledge around new productive zones along the Senegal River, and new models of energy.	**	1,2,8
Unsustainable water use, with high use of non-renewable energy for irrigation.			***	12



<p>Processing opportunity in Casamance (potential roadmap to fresh exports).</p>	<p>3</p>	<p>Explore the feasibility of a processing opportunity in the Casamance (juice, dried fruit, frozen cubes). Post-harvest logistics development – infrastructure, organisation of farmers or collectors. These interventions lay the foundation for an expansion of existing fresh mango exports.</p>	<p>***</p>	<p>1,2,8</p>
<p>Lack of a competitive processing sector, which could become problematic when production of fresh ramps up.</p>	<p>4</p>	<p>Explore the feasibility of a processing opportunity in the Niayes (juice, dried fruit, frozen cubes).</p>	<p>***</p>	<p>1,2,8</p>
<p>No availability of new Genetic material &amp; nurseries in the Casamance</p>	<p>5</p>	<p>Explore new nursery models for the Casamance. This will require a cleared understanding of the end markets- fresh, processed etc. and whether there is a case for investing in commercial orchards or paid trees.</p>	<p>**</p>	<p>1,2,5</p>
<p>Orchard maintenance services.</p>	<p>5</p>	<p>Expand support of commercial orchard maintenance services (investment promotion and technical support).</p>	<p>*</p>	<p>1,2,8,4</p>

Sustainable Development Goals



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**SENSE**

## Value Chain 2 - Onions



## 1 Executive Summary

Onion is a cornerstone of Senegalese cuisine. Only 4 countries in the world consume more onions per person. It is the most popular vegetables in the country with growing demand each year. Most Senegalese prefer red skin onions such as the local variety Violet de Galmi. This is red shallot type onion, that is known for being very flavoursome. To satisfy this demand for onions local producers have expanded production three-fold since the early 2000s.

This has been helped by a supportive local policy environment. Many measures have been introduced since 2003 that protect local producers. During the critical months for February through August, when local producers bring product to market, imports are banned. In addition, import tariffs and import quotas exist that help to make local onions more price competitive.

Nevertheless, the Senegalese increasingly rely on imported red skin onions, largely from the Netherlands. Over the last 10 years imported Dutch onions have won market share in local onion markets. As a result, nearly half of all onions eaten in Senegal are sourced from the Netherlands. At the start of the Dutch season this is the number 1 export market for Dutch exporters. They are valued by traders and consumers alike for their superior quality when compared to Senegalese onions and thus sold at premium prices.

A key question is what prevents Senegalese producers from producing a better-quality onion?

- Firstly, agri-ecological conditions mean that onion needs to be produced during the cooler dry season (early season October-May; late season May-July). As a result, the onion marketing season in Senegal is February through to August. Yet, the bulk of onions find their way to market during May. This flood of onions during the peak of the marketing season in May, result in a price crash that leaves many producers having to accept low prices. Because of poor quality it is difficult to avoid the glut by storing onions
- Furthermore, seed quality has degraded in Senegal. The dominant supplier of seed, Tropicasem, is known for sourcing seed of indeterminate origin and poor quality. As a result, the dominant variety, the Violet de Galmi, is quite unpredictable. Early flowering in the first year, poor germination, low yields are all expected and experienced by most producers.
- Most farmers are uncertain that any investments in good agricultural practices would result in an onion that is more storable. Loss rates from stored onions over 4 months have been estimated at 50%. This negates the benefit of any price increases from bringing product to market later in the season, while increasing risk for the farmer. As a result, farmers focus on speed to market. Good growing techniques, helpful for creating quality onions with properties best suited for storage- are almost entirely ignored. Farmers over water, over fertilize, harvest early and with too much haste and too little care. An onion that is intrinsically poor and perishable is made worse.
- On the demand side of the equation, buyers of onions simply don't know whether the onion they are looking to buy is worth a premium price or is only days away from rotting. Consequently, traders often use a consignment system. In this system farmers are paid when the onions are sold, and thus carry the risk of price crashes, spoilage etc.
- The risk profile in this chain discourages farmers from seeking credit and banks from offering relevant solutions to the bulk of growers. This in turn leaves those farmers able to self-finance to focus on getting their 2 crops out as quickly as possible. Or in the case of those in the Senegal River Valley where one cycle is possible, to rely on traders for pre-financing of crops. This of course reinforces the need to get the onion crop to harvest and



to market as quickly as possible, while reducing the bargaining power of farmers in the transaction.

This is a vicious circle. Farming practices focus on increasing growth rates. But these also increase the perishability of the product. The more perishable the product, the greater the focus on speed to market and the more likely the bulk of onions will hit the market at the same time. And on and on it goes in a race to the bottom. Only industrial producers escape from this circle and are increasingly investing in onion production. And the fuzzy business case for storage for producers has held back the expansion of commercial storage beyond a few examples.

There is an overwhelmingly long list of issues in this chain. With the importance of onions to the Senegalese diet and increasingly widespread cultivation of onions along the Senegal River Valley, the Niayes and new regions, there is a considerable case to be made for turning this situation around. Breaking small scale farmers out of this vicious cycle, with boom-and-bust prices, would be immensely beneficial to rural livelihoods. It could reduce the significant waste in this chain and offers opportunities for the Senegalese consumer to get better value for the onions they buy. Finally, there is a lucrative market opportunity that is currently not being fully exploited for better quality onions locally and in the region.

Critical to this turnaround will be 4 interventions:

1. A seed systems intervention to make reliable seed more widely available to small scale farmers.
2. The development of a quality premium onion segment for small scale farmers either domestically or to countries in the region.
3. A knowledge and expertise development workstream to ensure better production, irrigation and farming techniques for the Senegalese context.
4. A farmer training and support intervention to disseminate good farming practices and develop the business acumen of small-scale farmers. This includes expansion of agricultural services such as access to quality inputs, irrigation and mechanization services.

These interventions will ready producers for storage and will create the conditions where expansion of commercial storage, especially in the Niayes, will become an investable case. In many respects Dutch cooperation is well suited to tackling the critical bottlenecks in this value chain. Knowledge, technical expertise, quality inputs are all areas where Dutch Industry, knowledge institutes and the onions sector excel. As a result, there are many areas where cooperation would provide mutual benefit.

## Résumé Oignons

L'oignon est une des bases de la cuisine sénégalaise. Seuls 4 pays dans le monde consomment plus d'oignons par personne. C'est le légume le plus populaire du pays, dont la demande augmente chaque année. La plupart des Sénégalais préfèrent les oignons à peau rouge comme la variété locale Violet de Galmi. Il s'agit d'un oignon de type échalote rouge, qui est connu pour être très savoureux. Pour répondre à cette demande d'oignons, les producteurs locaux ont triplé leur production depuis le début des années 2000.

Le contexte politique local favorable a rendu possible cette triplification. Depuis 2003, de nombreuses mesures ont été introduites pour protéger les producteurs locaux. Pendant les mois décisifs de février à août, lorsque les producteurs locaux mettent leurs produits sur le marché, les importations sont interdites. En outre, il existe des droits et des quotas d'importation qui contribuent à rendre les oignons locaux plus compétitifs en termes de prix.

Néanmoins, les Sénégalais dépendent de plus en plus des oignons rouges importés, principalement des Pays-Bas. Au cours des dix dernières années, les oignons néerlandais importés ont gagné des parts de marché sur les marchés locaux de l'oignon. Ainsi, près de la moitié des oignons consommés au Sénégal proviennent des Pays-Bas. Au début de la saison néerlandaise, le Sénégal est le premier marché d'exportation pour les exportateurs néerlandais. Les oignons sont appréciés par les commerçants et les consommateurs pour leur qualité supérieure à celle des oignons sénégalais et sont donc vendus à des prix élevés.

La question à se poser est de savoir ce qui empêche les producteurs sénégalais de produire un oignon de meilleure qualité.

- Premièrement, les conditions agroécologiques impliquent que l'oignon doit être produit pendant la saison sèche, qui est plus fraîche (début de saison : octobre-mai ; fin de saison : mai-juillet). Par conséquent, la saison de commercialisation de l'oignon au Sénégal va de février à août. Pourtant, la majeure partie des oignons est commercialisée au mois de mai. Cet afflux d'oignons au plus fort de la saison de commercialisation en mai entraîne un effondrement des prix qui oblige de nombreux producteurs à accepter des prix bas. En raison de la mauvaise qualité, il est difficile d'éviter la surabondance en stockant les oignons.
- En outre, la qualité des semences s'est dégradée au Sénégal. Le principal fournisseur de semences, Tropicasem, est connu pour s'approvisionner en semences d'origine indéterminée et de mauvaise qualité. Par conséquent, la variété dominante, le Violet de Galmi, est assez imprévisible. Une floraison précoce la première année, une germination médiocre, de faibles rendements sont autant d'éléments que la plupart des producteurs redoutent et subissent.
- La plupart des agriculteurs ne sont pas certains que le fait d'investir dans de bonnes pratiques agricoles se traduirait par un oignon plus facile à stocker. Le taux de perte des oignons stockés pendant 4 mois a été estimé à 50 %. Ces pertes annulent l'avantage de toute augmentation de prix résultant de la mise sur le marché du produit plus tard dans la saison, tout en augmentant le risque pour l'agriculteur. En conséquence, les agriculteurs se concentrent sur la rapidité d'accès au marché. Les bonnes techniques de culture, utiles pour créer des oignons de qualité aux propriétés les mieux adaptées au stockage, sont presque entièrement ignorées. Les agriculteurs arrosent trop, utilisent trop d'engrais, récoltent tôt, à la hâte et en faisant preuve de négligence. Un oignon qui est intrinsèquement pauvre et périssable est pire.



- Du côté de la demande, les acheteurs d'oignons ne savent tout simplement pas si l'oignon qu'ils cherchent à acheter vaut un prix élevé ou s'il va pourrir dans quelques jours. Par conséquent, les commerçants appliquent souvent un système de consignation. Dans le cadre de ce système, les agriculteurs sont payés lorsque les oignons sont vendus, ce qui comporte le risque de chute des prix, de détérioration, etc.
- Le type de risque de cette chaîne décourage les agriculteurs de demander des crédits et décourage les banques de proposer des solutions adaptées à la majorité des producteurs. Ainsi, les agriculteurs qui peuvent s'autofinancer se concentrent sur l'obtention de leurs deux récoltes le plus rapidement possible. Ou, dans le cas de ceux de la vallée du fleuve Sénégal où un seul cycle est possible, ils s'appuient sur les négociants pour le préfinancement des cultures. Cela renforce bien sûr la nécessité de faire en sorte que les oignons soient récoltés et commercialisés le plus rapidement possible, tout en réduisant le pouvoir de négociation des agriculteurs dans la transaction.

C'est un cercle vicieux. Les pratiques agricoles sont axées sur l'augmentation des taux de croissance. Mais elles rendent également le produit plus périssable. Plus le produit est périssable, plus l'accent est mis sur la rapidité de mise sur le marché et plus il est probable que le gros des oignons arrivera sur le marché en même temps. Nous assistons donc à un nivellement vers le bas continu. Seuls les producteurs industriels échappent à ce cercle vicieux et investissent de plus en plus dans la production d'oignons. Des arguments commerciaux flous en faveur du stockage pour les producteurs ont freiné l'expansion du stockage commercial, en dehors de quelques exemples.

La liste des problèmes qui se posent dans cette chaîne est extrêmement longue. L'importance de l'oignon dans le régime alimentaire sénégalais et le fait que la culture de l'oignon soit de plus en plus répandue le long de la vallée du fleuve Sénégal, dans les Niayes et dans de nouvelles régions appellent un renversement de la situation. Sortir les petits agriculteurs de ce cercle vicieux, avec des prix en dents de scie, serait immensément bénéfique pour les moyens de subsistance des populations rurales. Cela pourrait réduire le gaspillage considérable de cette chaîne et offrirait au consommateur sénégalais la possibilité d'obtenir une meilleure valeur pour les oignons qu'il achète. Enfin, pour des oignons de meilleure qualité au niveau local et régional, il existe une opportunité de marché lucrative qui n'est actuellement pas pleinement exploitée.

Quatre interventions seront essentielles à ce revirement :

1. Une intervention portant sur les systèmes de semences pour rendre les semences fiables plus largement disponibles aux petits agriculteurs.
2. Le développement d'un segment d'oignons de qualité supérieure pour les petits agriculteurs, soit au niveau national, soit dans les pays de la région.
3. Un axe de développement des connaissances et de l'expertise pour assurer de meilleures techniques de production, d'irrigation et d'agriculture dans le contexte sénégalais.
4. Une intervention consistant à former les agriculteurs et à les soutenir pour diffuser les bonnes pratiques agricoles et développer le sens des affaires des petits exploitants. Cela inclut l'expansion des services agricoles tels que l'accès à des intrants de qualité, à des services d'irrigation et de mécanisation.

Ces interventions prépareront les producteurs au stockage et créeront les conditions dans lesquelles l'expansion du stockage commercial, en particulier dans les Niayes, deviendra un enjeu dans lequel investir. À de nombreux égards, la coopération néerlandaise est bien adaptée pour s'attaquer aux freins critiques de cette chaîne de valeur. Les connaissances, l'expertise technique, les intrants de qualité sont autant de domaines dans lesquels l'industrie néerlandaise, les instituts

de connaissances et le secteur des oignons excellent. Par conséquent, il existe de nombreux domaines dans lesquels la coopération serait mutuellement bénéfique.



## 2 Background and Method

The aim of this study is to provide insights into the Senegalese onion value chain and to define critical interventions that are needed for the sector to flourish. The insights will be used to provide guidance to development and knowledge partners as they work in these intervention areas. Finally, these will be used by the private sector, who at a later stage might be encouraged to trade and deliver much needed equipment, inputs and expertise. Ultimately it is hoped that these interventions will play a useful part in fueling an improvement in the livelihoods and food security of the Senegalese people, while improving the lot of women and youth and the environment.

More specifically the study aims to (i) describe the market, production and enabling environment in the onion chain in Senegal (ii) reveal the key issues, opportunities and bottlenecks in the value chain (iii) propose specific interventions that can help to address these bottlenecks & allow for the value chain to have greater impact (iv) identify areas where inclusive participation of women and youth in the economy can be stimulated (v) highlight opportunities for improved circular economy practices (vi) recommend areas where public, private and the knowledge sectors can make valuable, if not unique, contribution to these interventions

The study involved 3 distinct phases. Firstly, desk research was conducted to understand the existing knowledge and open questions when it comes to the onion value chain. This was supported by interviews with subject matters experts. Generally, these were people, businesses or institutions who provide supporting services, knowledge development or institutional support in the agricultural sector in Senegal. To get a better understanding of Dutch expertise and strategic and commercial interests, interviews were conducted with businesses who trade with Senegal, professional sector organisations, research institutes or service providers who offer knowledge services in aid of Senegalese agricultural development etc. Subject matter experts were also consulted about specific issues related to seed, mechanization, salinization, irrigation, storage etc.

In step 2 we carried out field research in the Senegal River Valley area as well as in the Niayes. This included visits to farmer groups, marketing platforms, financial institutions, the Senegal River Valley Development Authority (SAED) and industrial growers.

Finally, in step 3, field research was conducted with 75 consumers, 15 traders and representatives in 3 cities/town in Senegal viz Dakar, Thiès and Pikine. 5 representatives from the Hotel restaurant and catering field (HoReCa) were interviewed in Dakar.

We must highlight that this research was carried out during the COVID 19 period, but after local constraints on travel were lifted. This has both advantages and disadvantages. A large number of interviews could be conducted telephonically, which made including a variety of perspectives and experiences from Senegal and the Netherlands far more possible. In some instances, the new “work from home” norm made interviewees more available. A downside was that research was carried out later than planned- outside of the key production period for onions. Nevertheless, access to farms, financial institutions and marketing platforms was possible during the fieldwork. These greatly enriched the quality of insight reflected in this report.



### 3 The Market

#### 3.1 Overview

Each Senegalese citizen is estimated to consume 27 kg of onions- largely the Violet de Galmi or other equally spicy varieties. Only 4 nations on earth eat more onions per person. And consumption is increasing. Only 10 years ago Senegalese ate 5 kg per person less than today.

On average about 36 000 tons of onion are consumed per month. Despite the strong growth in production, Senegal is only 65% self-sufficient and relies on over 164 000 tons of imports to satisfy its onion needs. This volume has been increasing over the last decade.

Figure 25: Import and Production of Onions in Senegal

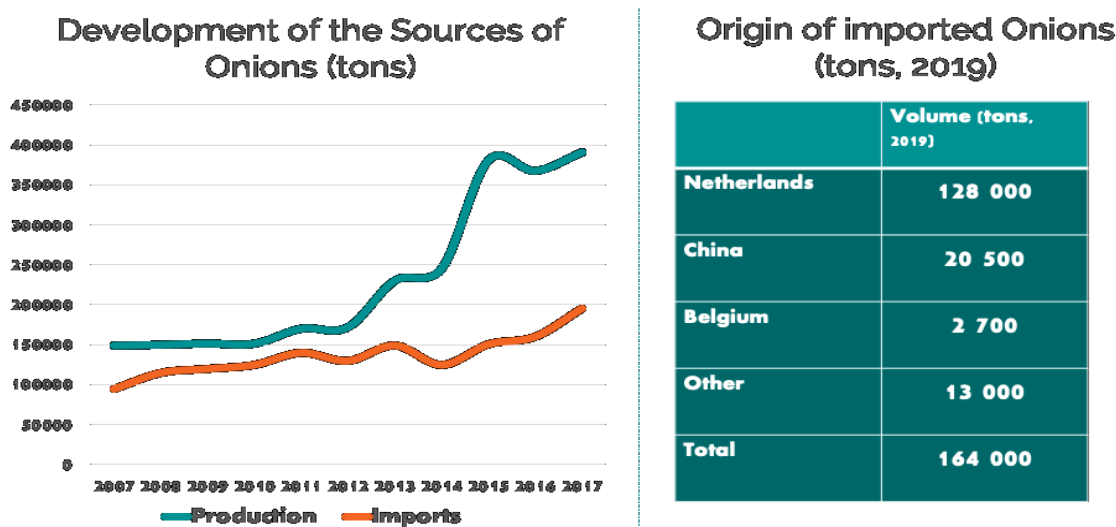
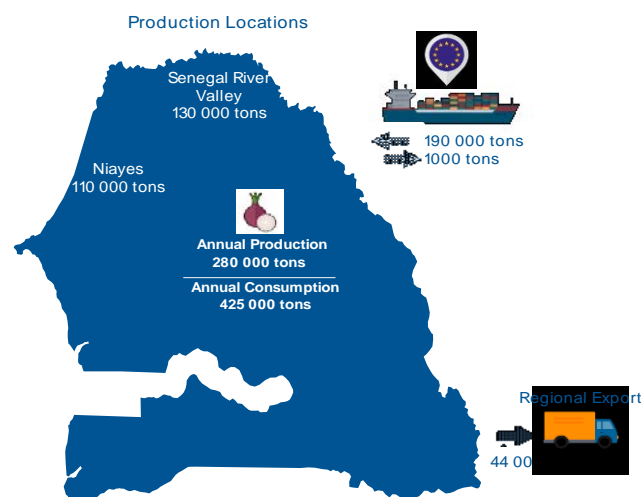


Figure 26 Production Locations



Of these imports roughly 128 000 tons is sourced from the Netherlands, with the balance arriving from China and an assortment of other countries. The strong growth in local onion production is possible because of strong market protections. Between October and January each year approximately 30 000 tons of onions are imported per month from the EU, which in reality is



largely from the Netherlands. These volumes are controlled by the Market Regulation Agency (ARM), who issues import permits linked to a quota system. Thereafter a local import freeze comes into effect. This gradually reduces imported onion stocks, which are increasingly replaced by local onions, which are now ready to be marketed. Between February and May, as more regions come to the end of their growing season more onions become available on the market. By May volumes peak at about 50 000 tons, with a small volume of imported onions still available (roughly 1000 tons).

Thereafter, increasing temperatures reduce local production volumes. By August a tipping point is reached in sourcing. Local volumes have decreased to a third of the monthly average volumes before falling precipitously in September. The import window must once again be opened in order to meet demand. From October the market is once again reliant on imported onions to meet demand.

### 3.2 Intermediate Quality, Medium Price Opportunity

Senegalese shoppers are very clear about the characteristics of quality onions. A firm texture, beautiful red colour and tight skins all suggest a durable onion which they prefer. This is typical of the imported Dutch onions (consumer interviews, 2020). And because they are more storable these onions are available even outside of the import season. Whatever the season, these quality onions fetch higher prices compared to local onions (300-455 FCFA versus 220-360 FCFA for local onions).

The quality of most local onions is low, as a result of farming practices focussed on bringing onion as quickly on the market as possible. There are however signs that local better quality onions might be performing well. In the 2017 season a price differential of 50 FCFA to 100FCFA was seen on local onions at marketing platforms (FAO, 2018). Also, local onion prices on average peak at prices above the normal import selling price i.e., in the import season. Local shoppers, it would seem, are willing to pay for quality.

### 3.3 Regional Export Opportunity

During the key production months in Senegal i.e., March - May, several West African countries are importing onions both from the EU and from countries in the region. In 2018, Ivory Coast specifically imported roughly 50 000 tons of onions, sourcing 80% of that volume from Niger and Burkina Faso. During that same period onions arrive from the EU, led by the Netherlands and then smaller volumes from France, Spain and Belgium. This does suggest that there is a market for quality onions in the region, especially in Ivory Coast, where import volumes are particularly large.

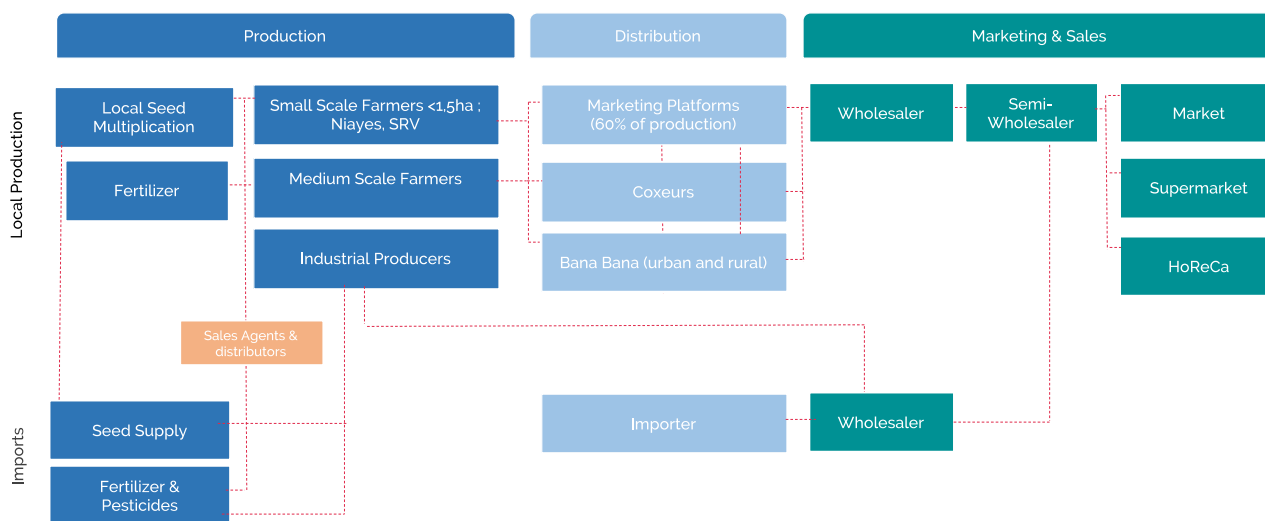
Figure 27 Onion Imports for Ivory Coast in 2018 by Source (ITC Trade Map)

	March	April	May
Niger	5 800	7 000	9 360
Burkina Faso	9000	5000	2880
Netherlands	2500	3350	3000
Other	700	770	760
Total Imports	18 000	16 120	16 000

## 4 The Structure of the Value Chain

### 4.1 Overview

Figure 28 Map of the Value Chain



### 4.2 Production

#### 4.2.1 Production Locations and Systems

The Senegal River Valley region and the Niayes are the key production locations for onions in Senegal. Together they account for roughly 85% of annual production. Continued demand for onions has led to new smaller production regions opening up as well as to increased industrialisation of production. In 2016 Thiès, Kaolack, Touba and Kolda produced approximately 15% of overall production. The large size of the onion market has also attracted interest from large scale industrial agriculture with a few important investments having been made in the recent years.

#### 4.2.2 Small Producers Applying a High Volume - Low Quality System in the Senegal River Valley

The core production region in Senegal is the Senegal River Valley, especially Podor and Matam and then sections of the Valley with a cooler micro-climate.

Onions are a winter crop. Seed is planted from mid- October to -November, which allows the onion bulbs to grow in the cooler, drier winter months (15-20oC). By early February, most farmers from the Senegal River Valley- the largest production area-aim to bring their onions to market. This in theory, would allow them early season prices before other regions come to market.

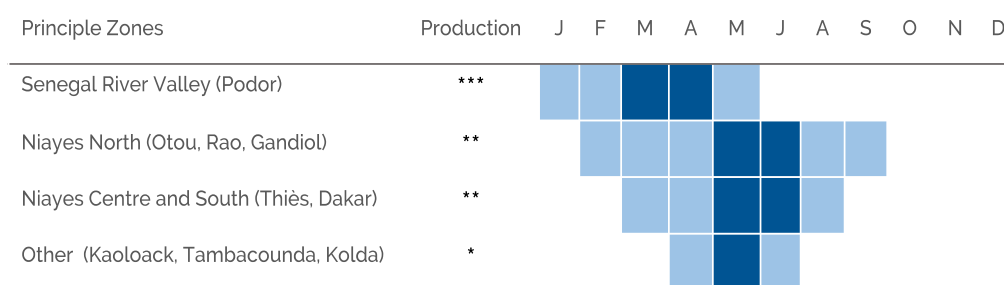
Then, later in the year, temperatures in this region rise to 40°C in the wetter May-October months. The dominant onion variety, the Violet de Galmi, is by nature relatively heat tolerant variety. However, these temperatures are simply too high for it to withstand. From May onwards high temperatures, termite infestations and wetter conditions, that sometimes result in flooding, make onion production less sensible. So, farmers switch production to rice. This is a wet season crop, that also benefits from various subsidies and is often an entry ticket to participating in state irrigation systems. Consequently, onion production in this region is limited to a single season.

Cultivation along this Valley requires irrigation. Farmers pump water from the river, sometimes storing it in large elevated tanks, and then use gravity irrigation or pumps to irrigate their fields.

### 4.2.3 Small producers With 2 Harvests in the Niayes

Cooler temperatures, especially in the Northern areas of the Niayes, allow producers in the Niayes region to potentially bring 2-3 harvests to the market. The first harvest coincides with the production from the Senegal River Valley and generates cash that can be used to finance a second harvest.

Figure 29: Production Season for Onions



In the Niayes, irrigation is also required. Water is drawn from wells and boreholes. The majority of farmers use manual irrigation. This system and relatively scarce labour later in the season limit these farmers to a single rotation. In contrast, those who have made the shift to solar- mini irrigation models are able to extend the season and benefit from a second late season crop.

This second harvest, typically marketed from May to June, enables these farmers to benefit from higher end-of-season prices. As a result, some make use of storage points, that are relatively better distributed in this region, to store onions. Typically, onions are stored for 6-8 weeks allowing farmers to benefit from higher prices as local supply begins to fall. A few cooperatives, supported by NGO’s, have begun trials with commercial storage.

### 4.2.4 Large Industrial Producers

Onions have only recently been produced on an industrial scale in Senegal. Large industrial farms were first set up in the Niayes region to cater to export markets rather than the local market for Violet de Galmi. In 2016, A large Dutch onion exporter to Senegal (Beemsterboer) invested in over 100 ha of farmland<sup>2</sup> to produce onions for the local market. Their initial model involved developing an outgrower scheme. However, for a variety of reasons related to implementation of the project, this attempt was unsuccessful. As a result, the prevailing model of development for industrial producers has become one of independent vertical integration.

More recently industrial producers of vegetables for the EU market during the winter months, as well as the largest potato grower in Senegal, have come to see onions as a useful crop to include in the annual crop calendar. Generally, onion production is seen as an add on to current activities. For vegetable growers it offers some degree of crop rotation. For others this is an opportunity to keep their land productive outside of their core season. This difference in focus means that they tend to grow onions later in the season. To allow for this late season production with higher temperatures and shorter day length, varieties such as Red King and Rouge D’Amposta are used.

<sup>2</sup> This is not all under cultivation

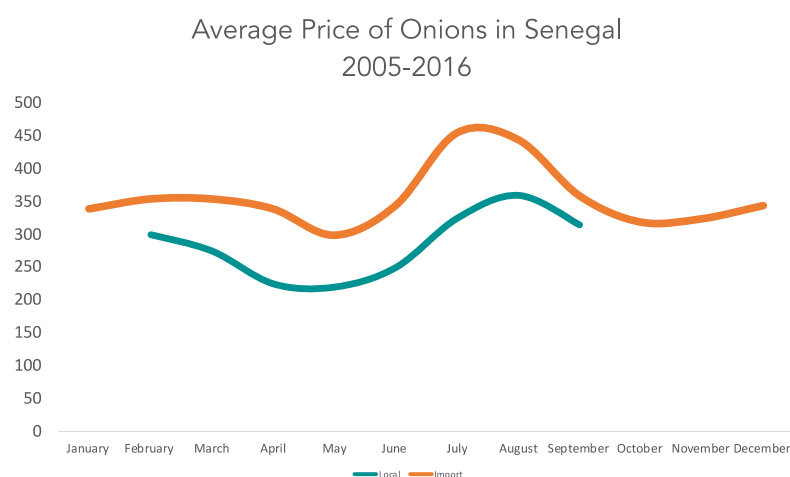
These are not the first preference of most local producers or shoppers and are not very storable. Another area where they are different from small scalars is their openness to a wider “product mix” and end customer. These producers also grow white onion varieties, that are able to deliver 5x the yields of the Violet de Galmi. But these are certainly not preferred by consumers. These farms include this variety in their production mix, with the aim of supplying the HoReCa segment.

### 4.3 Sales Prices Of Onions

Both the producers in the Niayes and along the Senegal River Valley tend to bring their produce to market from March to May. This creates a massive glut in the early season and so steep declines in prices follow. Those farmers who are able to get their product to market in February – sometimes only 10 weeks after planting—are able to benefit from high early season prices. However, for each week thereafter farmers fetch lower and lower prices.

This reaches a turning point in May. By this time most regions have brought their onions to market and prices begin to rise for the few producers able to supply onions. Imported onions are available in small quantities outside of the import season and are sold as a premium to local onions. Figure 6 provides an overview of the seasonality of prices, based on average prices over the 2005-2016 period.

Figure 30: Onion Prices Throughout the Year



Source: Améliorer la qualité de l'oignon au Sénégal Contractualisation et autres mesures transversales FAO, 2018

## 4.4 Input Supply

### 4.4.1 Formal Seed Provision

Farmers in Senegal source seed largely from the private sector. A variety of seed is available in Senegal that allows for production in both the cold season and the early part of the hot season. Importers form the cornerstone of this portion of the onion value chain. Tropicasem is a major player, importing seed that has been tested for being suitable for local conditions. Alongside Tropicasem are a number of other private sector seed importers. Bejo Seed, EWS, SEMADONIS seed and La Cigogne, are just some of the seed-brands available from international seed suppliers.

#### 4.4.2 Semi-Formal Seed Provision

Seed multiplication systems for grains have had a fair deal of support in Senegal. In contrast the local onion seed multiplication system is rather less developed. Nevertheless, seed multiplication associations exist, that work with multipliers to learn the techniques needed for seed multiplication.

In this semi-formal system, producer associations are able to multiply seed in the very early start of the season. This seed is then used by the farmers themselves or sold to neighbours and personal networks either as seed or as bulblets for transplanting in the next season.

#### 4.4.3 Varieties

Figure 7 provides an overview of the varieties available in Senegal.

Figure 31 Overview of Dominant Onion Seed Varieties

Variety	Cold Season Crops			Hot Season Crops
	Early Crops (hasty)	Full Season Crops	Medium-Late Season Crops	Late Crops
Sowing Dates				
	October	November-December	January-February	March-April
Violet de Galmi	*	*	*	*
Orient	*	*	*	*
Gandiol F1	*	*	*	*
Texas Early Grano, Noflaye, Goldor, Red Passion, Goudamy	*	*		
Mercedes, Safari		*		
Red Creole, Red King, Yaka, Rouge d'Amposta, Jaune d'Espagnole, Gao				*

#### 4.4.4 Oversight & Regulation

Seed multiplication is technically overseen by the Seed Division (DISEM) who is responsible for issuing permits to import and multiply seed. At the regional level field checks are meant to be carried out by the Regional Directorate for Rural Development.

Finally seed research and development is managed by the Centre for Horticultural Development (CDH) from the Senegalese Research Institute- at least in theory. They are responsible for replenishing the seed genetics in Senegal. This requires them to source seed from Niger.

Finally, imports are regulated by the Directorate for Vegetable protection, who ensures that seed entering the country is free from disease and in a good condition for sale.

#### 4.4.5 Fertiliser & Pest Control Products

Fertiliser and pest control products are all readily available in Senegal via a privatised model of import and distribution. However, there is state subsidy of 50% on fertiliser for specific food security related crops like rice, maize and sorghum.

Phosphate, which is critical ingredient in fertiliser production, is mined in Senegal. However, privatisation of the state-owned company, ICSCHEM, responsible for producing fertiliser has

resulted in this key mineral largely being exported to India, Iran and Japan. This focus on export of the primary commodity as resulted in a decreased blending capacity for fertilisers. Only 1 company blends fertilisers in Senegal, on a limited scale (SPIA). Consequently, commercial fertiliser is largely imported in pre-packaged bags before being distributed as is.

This reliance on international suppliers means that standardised variations of NPK, DAP and Urea are readily available. In some cases, these come via regional blending plants in Ghana and Ivory Coast. However, farmers in the onion chain prefer to use Urea for its high nitrogen content. This speeds up growth significantly but has a very negative impact on the quality and particularly shelf life of the onion. It leads to bulbs with a high water-content that rot easily and are prone to damage as well as other defects caused by fast growth.

Two types of importers compete in Senegal. Firstly, those that participate in the state subsidised fertiliser system and secondly, those that are not allowed to participate.

Onions are not an official part of the subsidy program, but the system has a definite impact on the supply chain for these critical inputs. Importers engaged in the program retail both unsubsidised and subsidised fertiliser to producers of onions.

Those in the wholly unsubsidised system distribute their products via independent agricultural supply retailers, who generally travel to Dakar to purchase and collect product. Increasing competition has led some companies to develop more defined business relationships. For example, they are offering wholesale pricing, delivery, area exclusivity agreements, technical training etc. Nevertheless, the enhanced - some would say unfair - competitiveness of the companies in the subsidised program means that most importers tend to prioritise pest control products over fertilisers.

Finally, farmers are able to source animal waste (livestock, poultry and food compost). A 50-kilogram (kg) bag of organic livestock- based fertilizer costs about 650 FCFA, while poultry-based fertilizer costs 1,750 FCFA<sup>3</sup>.

Figure 32 Comparison of Cost of Various Fertilizers Available to Farmers

NPK (10kg bag)	DAP (10kg bag)	Poultry (50kg bag)	Animal Livestock (50kg bag)	Compost (Casuarina tree) per wagon
1200	1400	1750	650	2000

#### 4.5 Route to Market

The presence of imported onions alongside local small scaler and industrial onions makes for an interesting route to market.

<sup>3</sup>Animal manure fertilisers are applied in different quantities per hectare to industrially prepared fertilisers

Figure 33: Prices Along the Value Chain

Retail Price (Import)	300-455 FCFA/kg
Retail Price (Local)	220-360 FCFA/kg
Wholesale Price	
Marketing Platform	+181.60 FCFA /kg
Farm Gate Price	175 FCFA /kg

Onions produced by small scale farmers in Senegal make their way to the markets around the country by a fairly developed system that involves traders, agents, marketing platforms and wholesalers and finally retailers. This system stretches across the country making locally produced onions available in the local rural markets as well as the urban centres.

In contrast imported onions, have a shorter, more direct route with fewer actors involved in the chain. These chains meet at the retailer level.

#### 4.5.1 Traders (Bana Bana's)

As with many African value chains traders play a critical role in getting produce from the fields to the markets. They purchase onions at the farm, or at established marketing platforms. They then transport these to wholesalers in markets where the onions will be sold.

These traders are generally well informed and help to connect the consumer and producer markets. Some large producers sometimes act as collectors themselves collecting onions from smaller producers and marketing these. Bana Banas on supplying to either rural or urban markets.

#### 4.5.2 Coxeurs

Marketing platforms were designed to give farmers an additional avenue to market their onions to traders. Nevertheless, farmers continue to use coxeurs. These are commissioned agents who work on behalf of the farmer to market their onions at the marketing platform, or even to arrange direct sales from field to urban centers. In some cases, these coxeurs are themselves farmers.

The coxeurs play a useful role in the chain. By marketing onions for the farmer, farmers can continue with the job of farming. They also connect farmers with transporters and provide access to urban markets, albeit for higher costs.

#### 4.5.3 Marketing Platforms

To facilitate marketing and sales of onions, a network on marketing platforms has been created in the growing regions. After harvest, the onions are packed into 40 kg mesh harvest bags and readied for transport to marketing platforms or direct transportation to urban markets. They are generally not sorted into different quality grades. As a result, these onions are often resorted at marketing platforms. At the markets these onions are then sorted again and packed into smaller 24 kg bags, a size better suited to retailers.

Resorting and packing of the onions comes at a small fee per bag. In the Senegal River Valley area 200 FCFA is charged for sorting in addition to the various fees for taxes, handling, weighing and for coxeurs.



Figure 34: Fees and Levies and Taxes at Marketing Platforms

Fees, levies and taxes levied at marketing platforms					
	Taxes	Handling	Weighing	Sorting	Coxeur
Additional Fee per 40kg bag	+50 FCFA	+50 FCFA	+50 FCFA	+200 FCFA	+100 FCFA

#### 4.5.4 Wholesalers - local onions

In larger markets, traders may sell their onions to wholesalers, who then repackage the onions into smaller 24 kg bags so that they are more manageable volumes for retailers.

#### 4.5.5 Importers

About 10 onion importers supply the bulk of the imported onions. However, about 50 importers are involved in this trade. The import of onions is well regulated. Each year the Market regulation agency (ARM) works with the sector to determine the trade window as well as the volumes of onions that will be allowed into the country. Thereafter, importers can apply for a permit to import a specific quota of onions. For example, during the 2019 season, total onion imports were limited to 30 000 tons per month between October and January.

A key regulatory intervention since 2017 has required that importers get involved in developing the local onion chain as a precondition to being allowed to import. This is managed largely through the quota system. The size of the quota apportioned to each importers is based on 2 criteria. 50% is apportioned to importers based on their market share of imported onions in the previous year. 50% of the quota is based on their purchases of local onions.

#### 4.5.6 Wholesalers - imported onions, and industrial producers

Importers tend to market imported onions to specific wholesalers in Dakar. These then pack the onions into suitable bag sizes before selling these on to retailers. Industrial producers have a real preference for using these specific wholesalers to market their onions.

### 4.6 Indirect Actors in the Onion Supply Chain

The onion value chain is fairly organized in Senegal. A variety of indirect actors play (potentially) in its operations.

#### 4.6.1 Market Regulation

Since 2003, various measures were introduced to encourage the development of local production. Firstly, **tariffs of 35%** were introduced on imported onions. Secondly, a **temporary annual import ban** was put in place, allowing onions to be imported in a narrow window when local producers are not able to supply the market. Typically, the ban on imports is lifted from October to January, although the exact timing is determined by a steering committee of actors in the value chain as well as regulatory authorities. Imported onions are comparably very storable. To prevent importers from ordering large surplus volumes during the import window, a **quota system** was introduced. Finally, ARM consults with various actors in the chain to set **recommended selling prices**, field side and in Dakar. However, as these are only recommended prices, actual prices vary a fair deal.

#### 4.6.2 Professional Organisations

Professional organisations are a common feature of the agricultural sector. Various cooperative unions, producer federations, groups and associations all work in some way to organise farmers at the local, regional and national level.

In the Niayes, the **Association of Maraîcheres des Niayes Unions** (AUMN, from 2001) was created to support quality management, access to water and professionalization in their representation. It has received institutional support from the PAEP (Canadian cooperation) program, including a now failed project to create a quality brand label. The Association is now made up of 18 unions, that bring together 368 groups and total some 17,500 producers.

Two large associations are active along the Senegal River Valley- The **Valley Onion Producers Association** (APOV, from 2000) and the **Association of Onion Producers of Lower Delta** (APROBAD, from 2009). APOV organizes especially the area of Podor, the main production area in the country, while APROBAD organises the farmers in the newer areas further down the valley in Dagana. They work closely with the Senegal River Development Authority (SAED) to tackle some of the common issues they face.

Finally, since 2012, at a national level these associations come together as **IPOS**- the Senegalese Onion Producers Association. Ambitions are that IPOS will unite all of the players in the sector from inputs through to production, sales and marketing, to ensure an integrated development of the sector. IPOS plays a meaningful role in the annual discussions around the opening and closing of the import window and in the setting of recommended sales prices from ARM. More recently their ambitions have shifted to tackling the many production issues that are faced by the value chain. These activities are currently being supported by the Dutch Association PUM- who hopes to increase the capacity of this organisation.

IPOS faces some real challenges in becoming a true umbrella organisation for the chain. Firstly, the various producer organisations have very mixed levels of organisation, capacity and experience in working together and even different degrees to which they need to work together and can benefit from organizing. Along the Senegal River Valley area farmers have a very strong need to cooperate to manage water supplies. Specifically, around Saint Louis they have decades of experience in working together to solve these issues. SAED plays a useful role in bringing them together – even if it is often around specific project centred interventions. In contrast, the farmers in the Niayes, having a far more diverse range of crops, are less organized and producer groups tend to be far less effective.

A second issue is one of resourcing. To be of real value to the sector - and to achieve their ambitious project ambitions - the association requires a stable mechanism of financing. Experience in the Niayes, where the withdrawal of PAEP funding saw the collapse of their initiatives, shows that this is a critical component of getting the job done. It is difficult to see how they will succeed without external funding.

Finally, the large industrial producers have been reluctant to join IPOS. It's clear to see that the association would benefit greatly from the knowledge, organisational capacity and the resources of these potential members. Yet, at the moment, it's not clear how these businesses could benefit from becoming active members.

Some active local onion professional associations are:



- GPAR (Union des Groupements et agriculteurs de Rao)
- UFMT (Union Forestiere et Maraîcher de Thieppe)
- APOQ ( Association des Producteurs d'oignons de Qualités de Potou)
- UGPM (Union des groupements des producteurs de Mboro)

#### 4.6.3 Banks and Microfinance Organisations

In theory, onion farmers are able to access financing through La Banque Agricole (formerly **CNCAS**). However, the market risks in the onion chain, the volatile pricing, the high post-harvest losses and the poor fit of their financial products for small scale farmers make for a poor match.

Most farmers who are not able to self-finance, get financing from traders or personal networks. Where they are interested in pursuing financing from the banking system, they tend to turn to micro-finance organisations. PAMECAS, the Union Financiers Mutualiste, LBA, UIMCEC and Credit Mutuel du Senega are some of the FI's extending loan products to small scale farmers.

These institutions offer unsecured lending, at 16% interest per year with a payback period of 3 years for investments in equipment or working capital for inputs. The growing popularity of solar irrigation- and the fact that it makes good business, mean that this has become an important area of activity for MFI's. These MFI's tend to work with the input and equipment suppliers, who provide interest free loans to the MFI's. They in turn assess the producers' credit needs, provide advice and conduct an assessment of the general credit worthiness of the recipients. The MFI's are also able to access funding from the Priority Investment Guarantee Fund (FONGIP).

#### 4.6.4 Input Supplier Financing

Co-funding by input suppliers is common, especially for solar pump irrigation. They provide interest free loans to Microfinance institutions. They then provide credit products to farmers with a 16% interest rate.

#### 4.6.5 Agricultural Insurance In Senegal

Agricultural insurance been developed fairly recently in Senegal. The National Agricultural Insurance Company of Senegal offers a variety of insurance products in all agricultural sectors with the exception of livestock and fishing. Risks of crop failure due to flooding or (index insurance), to damage caused by birds, wildlife, etc. are some areas that are covered.

For onions, specific products have been developed in collaboration with ANCAR, PADEN. However, uptake of these products is still low.

#### 4.6.6 The Knowledge Sector

Knowledge and skills development are two important supporting activities in the agricultural sector. A sound structure would have a good combination of proactive research and development, which is then enriched and disseminated to professional education, vocational training and extension services.

Much of the development happening in this "vegetable" sector is driven by industrial private enterprises. Their closed nature however means that their knowledge is not widely disseminated. Nevertheless, it is helpful to get a better understanding of the general system of knowledge development and dissemination in Senegal. This is outlines below.

#### 4.6.7 Research and Development & Professional Skills development

Agricultural research and development falls under the remit of the Senegal Institute of Agricultural Research (ISRA). It falls under the Ministry of Agriculture and Rural Equipment's (MAER) but operates as an autonomous unit. The Institute of Food Technology and the Universities of Dakar, Thiès, Saint Louis and Ziguinchor all contribute to knowledge development in the sector. Some private companies are also involved in research. For example, Tropicasem conducts applied research. This involves testing whether the available seed performs in the Senegalese environment.

The local knowledge developers listed above also work alongside international actors. For example, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) of the CGIAR develop techniques and work on genetics in millets, sorghum and groundnuts. In Europe advanced research institutes and universities such as the Institute for Research on Development, France provide key insights and funding for a research thesis. These include sustainable agriculture, which could be helpful for the onion chain.

#### 4.6.8 Extension Services

Extension Services are designed to be coordinated and developed by **ANCAR**. This state funded agency has extension staff in each of Senegal's 45 districts and 190 counties. However, because of chronic shortage of funds there has been a high vacancy rate in the organisation since 2017.

To support ANCAR, Special Regional Development Agencies (**SRDR's**) were established by the government. They operate in particular zones and on particular theme. For example, the Senegal River Development Agency (**SAED**) was created in the Senegal River Valley to support the development of irrigated agriculture there. The Agency's advisory service employs 85 field extension staff equipped with motorbikes and 12 supervisors. Extension activities include participatory diagnosis, needs assessment, implementing activities and monitoring and evaluation. SAED receives funding from the government and is currently managing seven donor financed projects, funded by the African Development Bank, the French Development Agency, the Japanese International Cooperation Agency, the Korea International Cooperation Agency, the Kuwait Fund, the Saudi Fund for Development and the World Bank.

SAED are very active in onion extension services in the Podor region and are a key stakeholder in implementing projects in this critical onion growing region.

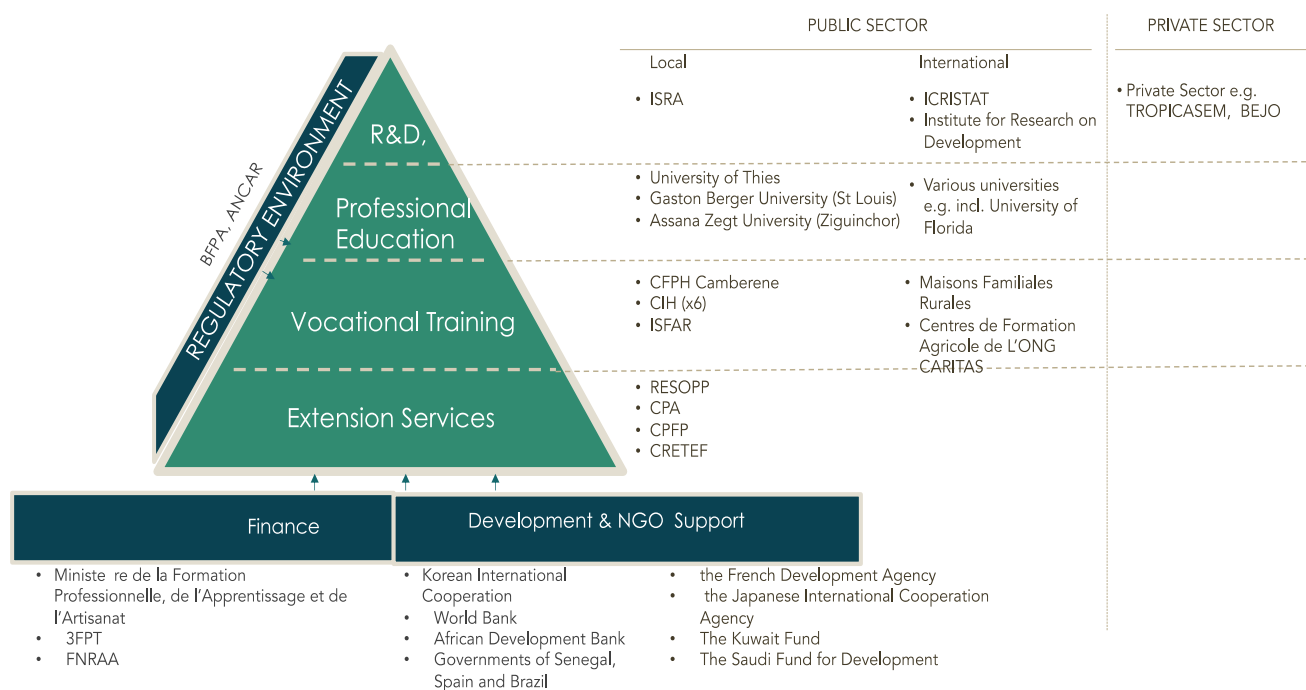
Another relevant agency is **ANIDA**. Founded in 2006, the National Agency for Agricultural is tasked with creating large, modern farms in "community agricultural domains," primarily to serve as employment opportunities for rural youth and to promote agricultural development. Twelve such domains are in operation and include over 100 farms. ANIDA employs 70 extension agents, who are supervised by 12 extension managers. Donors include the African Development Bank and the governments of Senegal, Spain and Brazil. In addition to extension services, these organizations provide a range of support including infrastructural development and supply of inputs.

Some professional and cooperative organisations provide training for their members. For example, RESOPP. This is a federation of farmer cooperatives, which offers training services to its member cooperatives as well as non-members. To realise this goal, they have training facilities in 8 out of the 15 regions in which Senegal is divided.



The "Centres Polyvalents de Formation des Producteurs" (CPFP) and the "Centres Régionaux de Formation Technique et Professionnelle" (CRETEF), provide training on agricultural techniques and innovative techniques for farming amongst other topics. These are targeted at producers.

Figure 35 Overview of Knowledge and Skills Development Actors in Senegal<sup>4</sup>



#### 4.6.9 Finance (Agricultural Knowledge Sector)

Financing of skills development and research and development related to agriculture is provided by the National Agro-Food Research Fund of Senegal. This is a government agency established in 2004 that mostly funds research but has recently started funding dissemination of knowledge. The National Fund for Agro-Sylvo Pastoral Development (FNDASP) provides funding to support for the dissemination and large-scale adoption of technologies. They also fund projects that will expand the availability of certified seeds for priority sectors by promoting sustainable seed systems. Finally, bilateral and unilateral donor agencies such as the World Bank provide financing within specific programs e.g. The World banks funded West African productivity program.

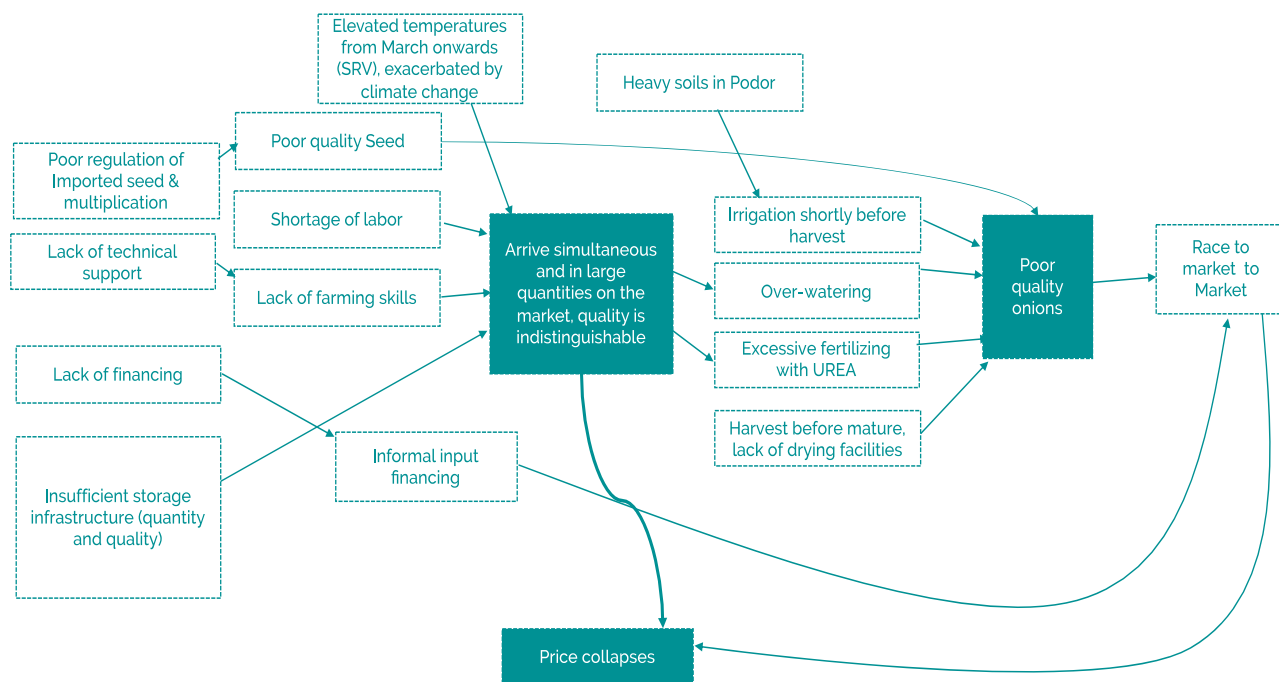
### 5 Issues and Opportunities along the Value Chain

The figure below resumes the most important issues and opportunities along the value chain. These are discussed in the following sections.

<sup>4</sup> Key pieces of information have been sourced from Action for Enterprise's report on the VALUE CHAIN SUPPORT MARKET ASSESSMENT REPORT: AGRICULTURE INPUTS IN SENEGAL



Figure 36: Overview of issues and Opportunities in the Value Chain<sup>5</sup>



### 5.1 Unreliable Seed Quality

There’s a defined policy framework for seed imports and multiplication in Senegal. DISEM provides authorization for seed multiplication after an importer has demonstrated that the variety meets acceptable standards. Typically, these include demonstration plots to test the viability of imported seed varieties. It’s not specific proactive research into the suitability of the seed to withstand specific local conditions such as increasing salinity. Also, while the Directorate of Vegetable Protection (DPV) ensures that the imported seed is healthy i.e., free from rot; it doesn’t ensure that the seed is qualitatively good i.e., has good germination rates and other positive traits.

Thereafter seed multiplication is intended to be controlled. Yet again, small budgets and low capacity prevent DISEM from providing any real regulatory control over the sector. They tend to delegate checks to the regional authorities, who lack resources to conduct field checks.

The failure to adequately control the quality of imported seed and seed multiplication has resulted in deteriorating quality of seed. For example, a producer could buy seed from an uncertified source; multiplied from poor basic seed; or could be lured in with claims of better yields than are verifiably possible. Farmers are thus unsure that the seed they buy will deliver the results they have invested in. This is made worse by a system of repacking seed into smaller pack sizes suitable for small scale farmers. But these bags tend to be very simple informal packaging, with no branding, instructions etc. So, year 1 flowering, low germination rates and poor-quality onions are just some of the common issues farmers regularly deal with as a consequence of this poor regulatory system.

<sup>5</sup> Inspired by and partially sourced from H el ene David-Benz et Abdoulaye Seck. Am eliorer la qualit e de l’oignon au S en egal Contractualisation et autres mesures transversales; FAO; 2018

Improvements to seed and ongoing research and development are important components to a dynamic, responsive production system. Yet, uncertain protection of the seed rights in practice has also resulted in established international seed producers abandoning local seed programs.

Finally, improvements to agricultural practices are required to ensure that farmers get full value from the relatively more expensive seed from EU suppliers.

## 5.2 Under-Resourced Plant Protection Agencies (DPV & DISEM)

The agencies responsible for the quality of seed in Senegal are hampered by a lack of resources. They have too few people and too small a budget to ensure that reliable seed quality control is possible. As a result, they lack quality laboratory infrastructure to be able to carry out rigorous testing. In the case of local seed multiplication- which occurs especially for other cereal crops- they lack the infrastructure for a track and trace system. Tackling these issues would provide some defence against deteriorating seed quality and the import and distribution of poor quality or fake seed.

## 5.3 Poor Farming Practices

The primary focus of farmers in this chain is to get their onion harvest to market as quickly as possible. As a result, they use farming techniques that focus on rapid growth and harvest rather than in growing onions of a good quality. To achieve this goal, they tend to over-utilise Urea, speeding up growth of the onions. The accelerated growth results in an onion that is large, but very soft and prone to bruising, gashes and ultimately spoilage.

Farmers often harvest before the onions have fully matured and dried. This is driven both by concerns around making an early market window as well as very real labour constraints. Farmers, especially in the Niayes area, rely on hired migrant labour to harvest their crops. However, these labourers face pressure to return to their own plots in order to prepare for the rainy season. Understandably these labourers are focussed on getting the job done quickly rather than ensuring that the onions are in a good condition. This affects yields. Estimates suggest that 5-10% of volume losses in the onion chain occur at this stage. Many onions are left in the fields rather than being harvested. The onions that are harvested in many cases are bruised and have nicks and cuts. In addition, the onions are often cut too close to the bulb allowing bacteria to enter.

Along the Senegal River Valley farmers often compete for access to tractors for land preparation, that are usually allocated to tomato growers who are more organised and able to lobby better in this area. They also grow onions in a heavy soil. So, without mechanisation, they tend to irrigate close to harvest to loosen the soil, which makes a faster, easier harvest. However, this is a critical drying period for the onions, which is essential for creating a firm, glossy onion that is storable. Instead, the onions are given an extra boost of water, which detracts from their quality. Mechanised land preparation including ridging and harvesting could solve this problem.

## 5.4 Underutilized and Insufficient Storage Infrastructure

The quantity, distribution and quality of storage in Senegal remains an important issue. It has been tackled by development actors with various degrees of success. As a result, about 50 conservation stores exist with a storage capacity of about 3500 tons. There are also consolidation platforms (two in the Podor region and 19 in the delta) where onions can be collected at the village level and then stored. However, storage is said to be inadequate because of the following reasons:

1. Storage capacity is far lower than production. Only 3 535 tons of storage is available, which is 1% of total production.
2. Despite the small capacity, the utilization rate of storage is low, in part because of the push for early sales and poor shelf life. Furthermore, the ownership is often questionable and management capacity can be insufficient. Finally, as we will explain the business case for storage is questionable.
3. Stores are in many cases technically inadequate: temperature and humidity controls, typical of storage in the Netherlands, do not exist widely in Senegal.

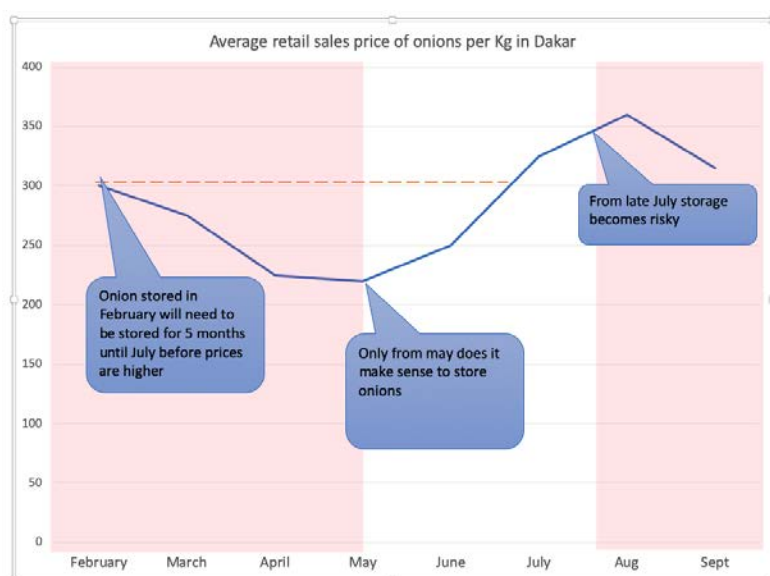
Some would argue that storage is poorly distributed: the Niayes has significantly more storage than the lead production area in the Senegal River Valley, Podor, which has only two stores, of 5 tons and 50 tons. Meanwhile Potou in Niayes has two 50 tons stores. However, as we will explain in the next section there is a very ambiguous business case for onion storage in the Senegal River Valley.

### 5.5 A Questionable Business Case Onion Storage

There have been many recent efforts to expand storage capacity in these areas as a means to slow the flow of onions into the market and achieve higher overall prices. These projects involve village level storage, development aid financed unrefrigerated storage as well as commercial, refrigerated models. In Dakar quality climate-controlled storage is available for 27 FCFA per kg per month.

Despite all the attention given to storage, the business case for a farmer to use storage, is difficult to make. Firstly, the window in which storage makes sense is very small. As figure 13 shows, it only makes sense to store onions from May up till the end of July. From February onwards prices continue to decline until May. Onions purchased in February would need to be stored until the end of July in order to fetch better prices. Constructing storage that can only be used 3 months of the year does not make financial sense unless there are other crops that can be stored year-round.

Figure 37: Average Retail Prices for Onions and Time Window for Profitable Onion Storage





This means that there at best a weak business case for early season storage, and thus for storage in the Senegal River Valley which only harvests in the early season. Hence the reason there are so few onion storage facilities in this region.

Secondly, even for most businesses that store onions at the lowest price point in the market the increase in sales prices do not outweigh the product losses in storage, the actual storage cost and the capital cost, nor do they provide a reward for the risk.

The loss rate in Senegal is high due to the poor quality of the onions: 20% over 3 months and 40% over 6 months. When onions are stored, they slowly lose water through evaporation, which also means they lose weight, and since they are sold by weight, they lose value. The water and weight loss depends on storage conditions, with onions stored in dry hot conditions losing more. But it also depends on the quality of the onions. In Senegal where onions are grown rapidly with high doses of urea and are not dried properly, moisture loss is much higher. Onions can also rot in storage or germinate. The quality of the onion as well as transport and storage conditions all effect these losses.

The cost of storage in a top of the line commercial climate-controlled warehouse in Senegal are 26 FCFA per kg per month. Allegedly, loss rates in this type of storage can be reduced to 5% over 4 months, but only with top quality onions. We have assumed a more traditional storage would have half the cost.

The typical interest rate for borrowing in Senegal is 16% per annum without collateral, and 1% with collateral. If we assume onions qualify as collateral, we can assume a cost of 1% per month, hence 2.25 FCFA/ kg per month.

Figure 14 shows the profitability of a number of storage scenarios. We have assumed a loss rate of 10% per month for poor quality onions in a traditional storage, half that (5%) in high tech storage, and 5% loss over 2-3 months with good quality onions in a high-tech storage.

Figure 38 Profitability of Late Season Onion Storage in the Niayes

	Onions											Profit		
	Purchase		Sale		Storage duration	Gross margin	Onion quality	Storage Loss		Storage type	Storage cost		Financial cost	
1	220	May	360	Aug	3	140	bad	30%	108	traditional	39	6,60	-13,6	-6%
2	250	June	360	Aug	2	110	bad	20%	72	traditional	26	5,00	7	3%
3	220	May	360	Aug	3	140	bad	15%	54	high tech	78	6,60	1,4	1%
4	220	May	360	Aug	3	140	good	5%	18	high tech	78	6,60	37,4	17%
5	250	June	325	July	1	75	bad	10%	32,5	traditional	13	2,50	27	11%
6	250	June	325	July	1	75	good	3%	9,75	high tech	26	2,50	36,75	15%
7	220	May	325	July	2	105	bad	10%	32,5	traditional	26	4,40	42,1	19%
8	220	May	325	July	2	105	bad	10%	32,5	high tech	52	4,40	16,1	7%
9	220	May	325	July	2	105	good	4%	13	high tech	52	4,40	35,6	16%

Retail prices are used in this example. But as a standard margin is taken at each stage of the value chain based on a flat FCFA fee, this holds true irrespective of whether the farmer, trader, wholesaler or dedicated storage facility commissions the storage.

The calculation illustrates there is no business case for storing poor quality onions in a traditional storage even if you would purchase at exactly the lowest price and sell at the highest price

(scenario 1). Leaving out a month of slow growth and thus reducing losses improves the situation but profitability is marginal. Storing bad quality onions in high tech storage (scenario 3) is also not profitable even if it reduces loss rates with 50%.

Scenarios 4, 6 and 9 shows that storing good quality onions in high tech storage is profitable.

Scenario 5 and 7 and 8 show that it is possible to make some profit in storing poor quality onions in high tech and in traditional storage if you manage to keep storage limited to the 1 or 2 months where the price increase is the highest.

However, we have to keep in mind that these profits are very fragile and assume traders or farmers are really able to buy at the lowest point and sell at the highest point. The reality – as any trader and stock market broker can tell you – is different. Furthermore, storage carries the risk of theft, fire, malfunctioning of climate control etc. Once all of those factors are priced in, there is little profit left.

In conclusion, onion storage is only potentially marginally profitable for farmers under very specific circumstances during a few months of the year in the Niayes.

## 5.6 Salinisation & Water Use

Irrigation is an essential component of onion production, both along the Senegal River Valley (pump irrigation) and in the Niayes (groundwater boreholes).

Over time these irrigated and fertilised soils create seepage of minerals into the groundwater. In the hot summer months, some farmers leave their land fallow, preferring to wait for cooler temperatures. But this draws water up from the groundwater table and further increases salinity of the soil. Even with clever selection of seed, there's a limit to what is possible for successful cultivation in saline environments.

This issue is especially critical in the Niayes region, where the underground water reserves being used for agricultural purposes feed the city of Dakar, or where city water is being used to irrigate crops. Usage by large industrial agricultural firms has increased the pressure on these precious water reserves.

This scarce resource requires better management. Firstly, to ensure that farms use only the least amount of water possible for successful cultivation. Secondly, some planning is needed for summer crops to keep the land in use. Finally, a longer-term planning is required to ensure that water resources are used sensibly. Without well thought through water and land management continued salinisation can be expected.

## 5.7 Access to Finance

The large fluctuations in pricing, poor quality of local onions and the weak case for storage all push established larger banks out of the sector. Nevertheless, micro-finance lending products are available to farmers who are looking to make investments in equipment, especially irrigation and solar pumps. These are generally available with no collateral requirements, but with the standard hefty interest rates that are associated with unsecured lending.

Those micro-finance institutions who have been extending credit in this area have generally expressed good results with relatively low default rates over the longer term, especially in the Niayes. Lower default rates are generally experienced with women's cooperatives, who tend to be more organised and more committed to repayment.

Small scale onion farmers who have accessed micro-finance lending products tend to have used the capital for investments in irrigation equipment, particularly pumps and solar power. And it has enabled both women and youth to enter onion production.

Nevertheless, it appears that many farmers are unaware that financing products exist at all. It's not uncommon for traders to provide pre-financing for inputs. This has consequences at harvest time when farmers rush to repay these loans and have decreased bargaining power with a buyer who is also a financier of the current and future crops.

A second key issue is that many have an aversion to taking credit from banks as they are themselves not confident that they will be able to repay it in the agreed time period. For these farmers variable climate and uncertainty around their crops – both in quantity, quality and the price they will fetch – undermine the case for taking out loans. Agri-insurance, especially as this relates to weather related incidents would seem to be a helpful solution. However, these markets especially for small scalers have not developed.

Finally, there is some case for improving financial literacy amongst these farmers, especially as it relates to growing onions as a business. Many were unable to provide clear answers around cost of production, marketing costs, the benefits of accessing working capital etc.

## 5.8 Agri-insurance

Agri-insurance is a new area of development in Senegalese agriculture. The CNAAS has developed products that focus on grain. But this coverage doesn't explicitly extend to onions. The system is also poorly organised and under-resourced. Banks would need to provide resources to market the insurance and later to conduct assessments of damages covered under the policies. Finally, the meteorological equipment needed to provide weather indexed insurance policies is insufficient in Senegal.

## 5.9 Fertiliser

Imported fertilisers in theory should deliver consistent product quality to the farming community. However, there have been complaints around cheating with the level of NPK in fertiliser that go back to the early 90s. To combat this issue a national fertiliser committee was created. But a lack of resources means that they rarely carry out checks on fertiliser quality. Chemical composition thus sometimes differs from that advertised on the bag.

Furthermore, the imported fertilisers generally have very standardised formulations that haven't been adapted to local growing conditions, nor to onion specifically. In addition, soil conditions are not tested and so farmers rely on generic advice around fertiliser application. This seems a fairly blunt approach for such an important crop. It is very likely that farmers are wasting money on adding nutrients already available in sufficient quantities, while underspending on nutrients being a limiting factor in achieving higher yields.

International investors, who have the ability to optimise these formulations, face local market conditions that discourage investments in larger more targeted fertiliser development, marketing and sales. Firstly, they face competition from the firms who are allowed to distribute fertiliser in the government subsidy program. Secondly, the subsidy program sets unrealistic price expectations for fertiliser in general. Thirdly, farmers rely heavily on Urea to speed up growth, and lack technical expertise and advice to steer them to quality fertiliser options.

### 5.10 Industrial Producer Issues and Opportunities

Industrial production of onions is expanding. Yet, despite the scale of production these farms still rely on a fair deal of **manual labour** rather than mechanisation. Harvesting in particular requires a fairly large staff complement.

Irrigation requires pumps to draw water from deep underground water resources. This makes the **cost of fuel linked to irrigation** a sizeable contributor to the cost of production. For cold storage energy requirements are also high as they require backup diesel generators.

**Skills** issues on these farms are another common issue. Staff might have relevant qualifications, but often they lack practical skills and experience to be productive. As a result, these farms must provide significant on the job training.

Industrial producers do however have a significant advantage over small scale producers. They have the **technical know-how** to invest in new varieties of production. These farms have introduced short day varieties such as Red King, Red Creole and white onions varieties to allow for production later in the onion season. Generally, they are able to avoid the many issues that result in the poor-quality onions produced by small scale producers. These farms are typically located in the Niayes and so they're well positioned for a **late season harvest** that benefits from rising prices. They source and use a better-quality seed, are able to extend their season with short day varieties, are able to prepare lands better. In this case storage makes sense- albeit with some concerns around high costs of fuel.

In addition, these producers have invested in **white onion production**, which delivers yields 4-5 times larger than the Violet de Galmi. This is typically sold to the HoReCa channel which is more open to white onion varieties. This is a limited local opportunity as shoppers prefer the red onion varieties. However, are there opportunities for regional export? Finally, these producers have the resources and experience in trading across borders to enable them to access opportunities in the region-which requires good volumes of quality onions.

### 5.11 Processing Issues and Opportunities

Processing of onions into onion powder has been a very popular idea for several years. Finally, it seems that this idea is going to be realised. An IFC supported project has been kickstarted to build an onion powder factory. Yet it's still in the early stages of development.

Supplying onions to this factory is however not as straightforward as it seems. Processing onions are generally a different variety to those enjoyed in the fresh market. Seed has been identified and tested. Yet poor farming practices delivered poorer results than expected.

A second and important issue to be aware of is that processing grade fruit and vegetables generally attract lower prices than those in the fresh market. The farmers that opt into this system will have a more certain customer and a simpler supply chain. But they will have to accept that this will come at the cost of at least a third of the average annual fresh market prices i.e., 80 FCFA per kg vs 265 FCFA per kg. Yield improvements or lower risks might indeed make for a good business case for farmers to switch wholly or in part to industrial onion production.

### 5.12 Marketing and Distribution

The shortened production season, the race to market and the issues around storage all combine to ensure that there's a large influx of poor-quality onions on the market in the first half of the season. With each passing week new areas are able to bring their onions to market. Prices fall sharply until about May. This **pressure to beat falling prices** is felt throughout the chain. The primary focus of the various actors involved in marketing and distribution is on speed rather than quality. The perishability of the product and the rapid changes in prices likewise discourage downstream actors from making any commitments to producers. Keeping their sourcing flexible is far more important.

Onion marketing involves a sequence of actors as well as additional handling as onions are packed and resorted at various intervals along the chain. This adds cost. But this is only one issue. The **additional handling (sorting and repacking)** of the predominately soft and fragile onions further reduces the quality of already sub-standard onions.

At various stages along the chain the onions are packed into 40 kg and 24 kg bags. Yet the **supply of harvest mesh bags is problematic** in Senegal. Therefore, most small-scale farmers use **second-hand packaging** for their onions. Often these still have the branding from suppliers who originally owned the bags. They can also be of questionable quality.

Traders and coxeurs all play an important role in getting onions to market. However, the current system places a great deal of risk on the farmer. Coxeurs receive a fixed fee for the sale of each bag. But the sales deal for the farmer requires that the farmer gets paid when the onions gets sold. The farmer provides the stock to the trader, who pays on the sale of the onions. This could be up to a month later. As a result, the **farmers carry the risk** of falling market prices, or even poor handling. They of course have little control over these issues.

The involvement of traders in pre-financing for the onion crop is both useful and disadvantageous to the farmers. At some stage, the farmer is forced to **negotiate sales prices with their financier**-placing the latter at a distinct advantage. Not only is the farmer negotiating prices, but he also must keep in mind the debt, or the potential need to request pre-financing in the next year.

Finally, the onions must be transported from the Senegal River Valley or the Niayes to markets around the country. The Niayes is of course closer to Dakar and so has better market access. Though significant progress has been made in improving the quality of roads in the primary road network and along the coastal areas, there is still much more that needs to be done. This is especially true when it comes to accessing rural areas. These logistic issues likewise affect the onion sector.



## 6 Environmental Sustainability (Circular Economy)

The agri-ecological conditions in Senegal create an environment that is fragile and particularly vulnerable to climate change. Firstly, with 47% of the land considered to be semi-arid, irrigation is required to produce horticultural crops like onions. Secondly, horticultural production is densely clustered in the Niayes, where water is drawn from underground wells that are a part of the aquifer feeding Dakar. In the case of the Senegal River Valley this water is drawn from the river using a system of petrol or solar powered pumps.

**Unsustainable water use** is undoubtedly the biggest challenge facing the onion value chain. Production in the Niayes relies on water from underground resources that ultimately feed the city of Dakar. Expansion in this zone requires a more sensible management at the farm level, but also at a systemic level. Little is being done to regulate the amount of water that each farm may draw from boreholes. At a more fundamental level this doesn't incentivize industrial producers to use this resource sparingly, nor to invest in techniques and seeds that minimize water use. At a systemic level more attention needs to be paid to land management and to planning of areas that will be used for production. Some deep introspection is required around the development plan for the Niayes. What crops should be zoned for this region, if any at all? Which productive activities in the Niayes should be redirected to other parts of the country?

The economic development plan for Senegal (PSE) encourages growth outside of the traditional growing areas. Yet more will need to be done to ensure that this is realized. In the case of onions expansion by small scalars down the Senegal River Valley helps to ease some of the pressure in the Niayes. Yet industrial producers continue to focus production in this area. Better planning is required to safeguard existing production in this area and to prevent the collapse of production as well as the water resources.

A second related issue is **declining soil health**. Continued irrigation, heavy application of fertilizers and pesticides and leaving lands fallow in the hot summer months all affect the salinity of the soil and the groundwater. While this affects small scalars to a certain extent, their traditional crop calendar and smaller scale of production mean that they raise a smaller threat. On the other end of the spectrum growing industrial production requires that some efforts be made to ensuring that these producers grow while incorporating more sustainable farming practices that protect soil health.

Finally, a discussion around circular economy in the onion change in Senegal requires that we focus on the unacceptably **high levels of waste** in the chain. These not only reduce the income of farmers, but also reduce the available onions that can be marketed locally or in the region. Improving these practices so that quality onions are brought to market can double the volume of onions available for consumption, while reducing inputs viz fertilizer and water and ensuring that each litre of fuel used for transport moves food rather than waste.

## 7 Socio-Economic Development (food security, employment, women and youth)

Onions form a cornerstone of Senegalese diets, with demand for this ingredient only expected to grow. Unsurprisingly, to cater for this demand nearly 22 000 households are thought to be involved in onion cultivation alone, with many more involved in marketing and distribution. A

sustainable, more inclusive production system would have a sizeable impact on rural livelihoods and food security. Some of the issues facing sustainable development are the volatility of prices and hence incomes; the structure of the market that pushes risk to farmers, growing risks from climate change and the low representation of women and youth in this chain.

### 7.1 Livelihoods and Food Security

Falling prices in the first half of the season and the tendency to push risk upstream towards farmers have already been mentioned as key issues. A review of the drivers of quality issues in the onion chain also reveals that farmers produce onions with relatively little technical, or financial support. Yet farmers face a variety of additional pressures. Unreliable inputs, climate change, low development of agricultural or financing products and growing production from industrial, highly competitive, producers all raise risks to their livelihoods. They produce a critical foodstuff in a harsh environment - especially along the Senegal River Valley - with very little support, technical skills or systems to manage risk or improve yields. Being able to generate a surplus, either in revenue or volume produced, would be helpful to both food security and livelihoods.

### 7.2 Inclusive Development

The onion value chain is at present a fairly masculine enterprise. Yet there are opportunities where women and youth can both benefit from the expansion of this chain.

#### 7.2.1 Seed Multiplication

Experience in the rice sector in Senegal demonstrates that seed multiplication is a promising area for youth and women. Firstly, these are not traditional activities for men. This creates space for women and youth to enter. Secondly, they require relatively smaller plots of land that can be acquired through rental. Thirdly, the revenue per hectare from seed multiplication is good with relatively low start-up capital needed. Finally, women and youth seem to prefer- and thrive an environment that require technical skills and in the case of women attention to detail. This is essential to a reliable, seed multiplication system.

#### 7.2.2 Youth & Practical Horticultural and Mechanisation Services

A critical issue in the onion chain is the need to improve the technical skills of farmers and their labour, seed multipliers and even input dealers. Critical to this is developing a skilled extension service system with trainers who are skilled and are continuously updating their skill set. This has a natural fit with the youth, especially if technology is introduced to the extension services. For example, if digital tools are used to dispense advice, provide weather reports etc.

Mechanization and irrigation services are likewise services that are better suited to a more youthful investor and workers. These are new areas, that provide space for the youth to establish themselves without having to displace established actors. The technical nature of these services also asks for continued education and skills development.

Enabling women and youth to make use of these opportunities requires a number of stumbling blocks to be removed. Firstly, without knowledge and skills, it is unlikely that they'll have the wherewithal to take on these opportunities. Secondly, social norms generally dictate that any savings or surpluses are used to finance activities of the men in the household, rather than those of women and youth. Developing a business requires finance. Even more so when this business relies of mechanization or irrigation equipment. Ensuring that they are aware of these opportunities and developing financial products specifically for these groups is a first step to



getting them involved in the chain. Another would be ensuring that they are armed with financial literacy. Finally, by organizing them in small producer groups they are better able to access financing, technical training and can be emboldened to take on these new challenges (IFAD, 2018).

## 8 Options for Intervention

### 8.1 SWOT Analysis

The following SWOT analysis resumes the foregoing issues:

<p>Strengths:</p> <ul style="list-style-type: none"> <li>– Market protections (import freezes for most of the year, quotas and tariffs)</li> <li>– Expanding production along the Senegal River Valley and new areas</li> <li>– Investment from Industrial producers</li> <li>– Privatised seed and input markets</li> </ul>	<p>Weaknesses:</p> <ul style="list-style-type: none"> <li>– Volatile pricing that encourages speed to market over quality</li> <li>– Cheating in the inputs market</li> <li>– Unreliable seed quality (poor regulatory control)</li> <li>– Distortionary effect of fertiliser subsidies on input marketing and sales</li> <li>– Relatively low yields (17-24tons per ha)</li> <li>– High waste due to unreliable inputs &amp; poor farming and harvesting techniques</li> <li>– Reliance on migrant labour at harvest &amp; labour for manual irrigation (especially in Niayes)</li> <li>– Heavy soils encouraging irrigation close to harvest along the Senegal River Valley</li> <li>– Risk carried by farmers</li> <li>– Under-utilized storage; insufficient capacity, quality and poor distribution</li> </ul>
<p>Opportunities:</p> <ul style="list-style-type: none"> <li>– Mid-tier; mid quality onions for local markets</li> <li>– Regional export opportunity in the peak production season, especially to the Ivory Coast</li> <li>– Space for women and youth in seed multiplication and agri-service development (mechanization, irrigation, storage)</li> </ul>	<p>Threats:</p> <ul style="list-style-type: none"> <li>– Unsustainable agricultural practices-water management, land management, soil fertility</li> <li>– Risks from climate change, increased salinisation</li> <li>– Pressure on groundwater suppliers that feed Dakar</li> </ul>



## 8.2 Interventions (SDG Goals and Impact, Dutch Transfers)

The critical challenge in the onion value chain is the vulnerability of farmers in the current boom-bust cycle and the very high levels lost value in system. Underlying this challenge is the issue of quality. How can farmers make a shift to quality onion production? While there's been a strong focus on expanding storage, it would seem that addressing quality requires an intervention far higher up the value chain. Without reliable seed of suitable varieties and the associated good agricultural practices, attempts to smooth out prices or improve livelihoods or food security through storage will be exceptionally challenging.

A host of supporting interventions are then relevant to support this transition. An intervention in the **seed system** seems crucial. Ensuring that the regulatory authorities have the skills, resources and systems to steer the sector and guarantee quality seed is foundational to the development of the sector. Supporting private sector seed providers to expand their reach and their offer would be very helpful. Yet, this seed system intervention provides an opportunity for the Senegalese agricultural sector to move from being a passive recipient of seed from the private sector, to becoming a more active player in the introduction of new improved varieties. This is key to ensuring that farmers not only have the best seed for current very challenging conditions, but also that they are adaptable to changing climate.

Making the shift to improved onion quality with better yields, lower waste and so higher value for the widest number of farmers will be greatly helped by a wide range of interventions around **farming techniques**. Widening access to reliable seed, fertilizers and pesticides; improving the agricultural practices of farmers, expanding access to irrigation and mechanization services all have the potential to improve returns- both in terms of quality, yields and ultimately value.

Capitalizing on the **opportunity for mid-quality onions** for the local and regional export markets could be a useful tool to getting the flywheel moving on quality onion production. Here supporting outgrower models where small scalers play an important role could be helpful in incentivizing the shift to quality production. This transition does however hinge on the ability to access the quality local and regional market on one end - with storage and packaging if required- & a guaranteed inflow of quality onions on the other. In this equation farmers will need support to access quality seed, fertilizers and pesticides and to upgrade technical farming skills. A knowledgeable off-taker with experience in industrial (onion) production would be most sensible, especially if the outgrower scheme is an addition to operations.

To ensure that the onion production system as whole remains sustainable there seems to be a need for ongoing **knowledge development**. Learning new techniques so that salinisation can be better managed if not reduced, that water resources are used sparingly, soil fertility is protected or improved will all be important ingredients for sustainable production.

Finally, the onion value chain provides opportunities for more **inclusive growth**. Women and youth can play an important role in the various interventions needed to support development in the chain. Seed multiplication, mechanization and irrigation service provision as well as agricultural extension services are all new areas where they can carve out a space for themselves. This will however require a focus on access to finance, services, skills development both of farmers and professional agri-skills.

## 8.3 Overview of proposed interventions

Bottlenecks	#	Interventions	Fit with Dutch Knowledge , Strategic interests etc.	SDG Goals
Poor implementation of existing regulations around seed multiplication along with a passive role in variety development	1	Strengthen Seed Systems Support especially capacity building for regulatory control & new variety development.	****	1,2
Unreliable seed quality	2a	Support the expansion of the private sector supply of quality inputs (seed, fertilizer and pesticides). Ensure that technical product training for distributors is a key part of the product offer.	***	1,2
Cheating in the fertilizer and pesticides markets, low skills and knowledge base of distributors				
Poor Farming and Harvesting Practices (timing, quality of inputs, techniques etc.)	2b	Improve extension services to improve skills of farmers (farming and financial literacy). This should include contributing to curriculum development of professional training centers (agronomic skills, machine repair etc.)	***	1,2,4
High waste/loss rates, reliance on manual watering especially in the Niayes; irrigation at harvest to loosen soils	2c	Support the expansion of mechanization, irrigation services & commercial storage (Niayes)	*	1, 2 12
Mid quality mid-priced onion opportunity (local and region market)	3	Support the development of outgrower models linked to improved quality production (incl. storage, packaging, GAP, quality inputs)	***	1
Unsustainable agricultural practices favouring salinisation, over-use of water, intensive cultivation in the Niayes etc.	4	Strengthen research and development into sustainable farming techniques, water and land management, soil fertility etc.	****	6,13, 15,
Opportunities for women and youth to deliver the “new” services required for development of the value chain	5	Support women and youth in participating in seed multiplication, mechanization and irrigation services, extension services etc. This requires a focus on access to finance and skills development.	**	4,5, 8,

### Sustainable Development Goals



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Many thanks to the following participants who shared their time so generously.

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economic | business | development

**SENSE**



## Value Chain 3 - Potatoes



## 1 Executive Summary

The agro-ecological conditions in the Niayes provide just the right environment for potato production. So unique is the environment that this is one of only 4 countries in the region that are able to grow potatoes.

Local consumption of potatoes is small but growing. The short production season (winter) in Senegal and a limited use of storage does however mean that the country relies on both local production and imports to satisfy demand. Market protections introduced in 2016 limit imports to a period of 5 months of the year. Heavy tariffs and import quotas have been instrumental in ensuring that production develops. The area under production has expanded in recent years, along with yields and more recently the type of investors interested in potato production. The dedicated potato farm owned by Senegindia in Mbane is so large that it is possibly the largest potato farm in Africa. Good technical skills have meant that yields in some parts of the farm are in line with the continental leader, South Africa.

From the perspective of livelihoods, small scale farmers are able to profitably grow potatoes, with returns on investment of more than double that of onions. Expanding potato production thus has benefits for the balance of payments (Senegal is the largest importer of potatoes in the region), for livelihoods and importantly for national food security. As consumption in the region grows there are distinct environment and food security benefits for having production close to market.

If the goal is to expand the sector, then are some real opportunities to ensure that this is sustainable and more inclusive. This requires interventions in the seed system, which is poorly regulated and supplies seeds of unreliable quality- sometimes too late in the season. A second concern is that seed imports are so poorly regulated that diseases are introduced from what seems late generation seed from the EU.

Improving agricultural practices is another important area of intervention. Introducing mechanisation for land preparation and harvesting; ensuring that potatoes are harvested at the right time and using suitable techniques are all important measures to ensuring that farmers at all levels of scale and sophistication get good returns from every inch of valuable agricultural land and water being used to produce potatoes.

Sustainable farming techniques, which include better water and land management are all important ingredients to ensuring the longevity of the sector. This must include wide adoption of crop rotation and soil fertility management, especially on the larger farms.

Finally, there are opportunities to make this a more inclusive chain, that in particular creates space for women and youth. Mechanisation and agricultural services are two areas where youth particularly are able to carve out niches for themselves, without having to compete for space with established demographics. This is especially helpful if there are efforts made to ensure that skills training of these two vulnerable groups is practical and applicable in the real world, where financial products in line with their needs are developed and brought to their attention; where especially women are organised in groups to be able to take advantage of these opportunities and finally that mechanisation and irrigation services are developed to make this chain more attractive and practically workable for them.

As a powerhouse potato producer and the world's leading potato exporter, Dutch enterprise and knowledge institutes hold many of the essential skills, technology and resources needed to realise these interventions. Developing local production also fits with the strategic interests of the sector. This makes for a useful alignment of interests and an ability of the sector- commercial, financial and knowledge- to make a positive impact on the development of the potato chain in Senegal.





## Résumé Pommes de terre

Les conditions agro-écologiques des Niayes offrent un environnement idéal pour la production de pommes de terre. L'environnement est si unique que ce pays est l'un des quatre seuls de la région à pouvoir cultiver des pommes de terre.

La consommation locale de pommes de terre est faible mais en augmentation. La courte saison de production (l'hiver) au Sénégal et le recours limité au stockage impliquent toutefois que le pays compte à la fois sur la production locale et sur les importations pour répondre à la demande. Les mesures de protection du marché introduites en 2016 limitent les importations à une période de 5 mois de l'année. Les droits de douane élevés et les quotas d'importation ont contribué à assurer le développement de la production. La superficie de production a augmenté ces dernières années, de même que les rendements et, plus récemment, le type d'investisseurs intéressés par la production de pommes de terre. La ferme de pommes de terre de Mbane, propriété de Senegindia, est si grande qu'elle est probablement la plus grande ferme de pommes de terre d'Afrique. Grâce à de bonnes compétences techniques, les rendements dans certaines parties de l'exploitation sont conformes à ceux du leader continental, l'Afrique du Sud.

Du point de vue des moyens de subsistance, les petits agriculteurs sont en mesure de cultiver la pomme de terre de manière rentable, avec un retour sur investissement plus de deux fois supérieur à celui de l'oignon. L'expansion de la production de pommes de terre présente donc des avantages pour la balance des paiements (le Sénégal est le plus grand importateur de pommes de terre de la région), pour les moyens de subsistance et, surtout, pour la sécurité alimentaire nationale. Une production proche du marché présente des avantages évidents en termes d'environnement et de sécurité alimentaire, car la consommation dans la région est en augmentation.

Si l'objectif est d'étendre le secteur, il existe alors de réelles possibilités de faire en sorte qu'il soit durable et plus inclusif. Cela nécessite des interventions dans le système des semences, qui est mal réglementé et fournit des semences de qualité peu fiable, parfois trop tard dans la saison. Par ailleurs, les importations de semences sont si mal réglementées que des maladies sont introduites à partir de ce qui semble être des semences de dernière génération en provenance de l'UE.

L'amélioration des pratiques agricoles est un autre domaine d'intervention important. L'adoption de la mécanisation pour la préparation des terres et la récolte, la garantie que les pommes de terre soient récoltées au bon moment et l'utilisation de techniques appropriées sont autant de mesures importantes pour garantir que les agriculteurs, à tous les niveaux d'échelle et de sophistication, obtiennent un bon rendement de chaque centimètre de terre agricole, d'une grande valeur, et de l'eau utilisée pour produire les pommes de terre.

Les techniques agricoles durables, qui comprennent une meilleure gestion de l'eau et des terres, sont toutes des ingrédients importants pour assurer la longévité du secteur. Cela doit inclure une large adoption de la rotation des cultures et de la gestion de la fertilité des sols, en particulier dans les grandes exploitations.

Enfin, il est possible de faire de cette chaîne une chaîne plus inclusive, qui laisse notamment de la place aux femmes et aux jeunes. La mécanisation et les services agricoles sont deux domaines



dans lesquels les jeunes, en particulier, sont capables de se créer des niches, sans avoir à rivaliser avec la démographie établie pour l'obtention d'un espace. Cela est particulièrement utile si des efforts sont faits pour que la formation de ces deux groupes vulnérables soit pratique et applicable dans le monde réel, où des produits financiers adaptés à leurs besoins sont développés et portés à leur attention, où les femmes en particulier sont organisées en groupes pour pouvoir profiter de ces opportunités. Enfin, des services de mécanisation et d'irrigation devraient être créés pour rendre cette chaîne plus attrayante et plus pratique pour ces groupes.

En tant que principal producteur de pommes de terre et premier exportateur mondial de pommes de terre, les entreprises et les instituts de connaissances néerlandais détiennent un grand nombre des compétences, des technologies et des ressources essentielles nécessaires à la réalisation de ces interventions. Développer la production locale convient également aux intérêts stratégiques du secteur. Les intérêts seront ainsi mis en commun et cela permettra au secteur (commercial, financier et de la connaissance) d'avoir un impact positif sur le développement de la filière pomme de terre au Sénégal.



## 2 Background and Method

The aim of this study is to provide insights into the Senegalese potato value chain and to define critical interventions that are needed for the sector to flourish. Ultimately it is hoped that these interventions will play a useful part in fueling an improvement in the livelihoods and food security of the Senegalese people, while improving the lot of women and youth and the environment.

More specifically the study aims to (i) describe the market, production and enabling environment in the potato chain in Senegal (ii) reveal the key issues, opportunities and bottlenecks in the value chain (iii) propose specific interventions that can help to address these bottlenecks & allow for the value chain to have greater impact (iv) identify areas where inclusive participation of women and youth in the economy can be stimulated (v) highlight opportunities for improved circular economy practices (vi) recommend areas where public, private and the knowledge sectors can make valuable, if not unique, contribution to these interventions.

The study involved 3 distinct phases. Firstly, desk research was conducted to understand the existing knowledge and open questions when it comes to the potato value chain. This was supported by interviews with subject matters experts. Generally, these were people, businesses or institutions who provide supporting services, knowledge development or institutional support in the agricultural sector in Senegal. To get a better understanding of Dutch expertise and strategic and commercial interests, interviews were conducted with businesses who trade with Senegal, professional sector organisations, research institutes or service providers who offer knowledge services in aid of Senegalese agricultural development etc.

In step 2 we carried out field research in the Senegal River Valley area as well as in the Niayes. This included visits to farmer groups, marketing platforms, financial institutions, the Senegal River Valley Development Authority (SAED) and industrial growers.

Finally, in step 3, field research was conducted with 75 consumers, 15 traders in 3 cities/towns in Senegal viz Dakar, Thiès and Pikine. 5 representatives from the Hotel restaurant and catering field (HoReCa) were interviewed in Dakar.

We must highlight that this research was carried out during the COVID 19 period, but after local constraints on travel were lifted. This has both advantages and disadvantages. A large number of interviews could be conducted telephonically, which made including a variety of perspectives and experiences from Senegal and the Netherlands far more possible. In some instances, the new “work from home” norm made interviewees more available. A downside was that research was carried out later than planned- outside of the key production period for potatoes. It also coincided with a major festival in Senegal. Nevertheless, access to farms, farming cooperatives and financial institutions were possible during the fieldwork- either face to face or via telephone or video calls. These greatly enriched the quality of insight reflected in this report.

## 3 The Market

Compared to the world average of 33 kg per capita per year the consumption of potatoes in West Africa is low. In 2020 Senegalese are estimated to consume just 22% of that volume per person. Yet, potato consumption is increasing. Where in 2011 they consumed on average of 6 kg per person, this has grown to 7.4 kg per person in 2019<sup>6</sup>.

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<sup>6</sup> <https://www.helgilibrary.com/indicators/potato-consumption-per-capita/senegal/>

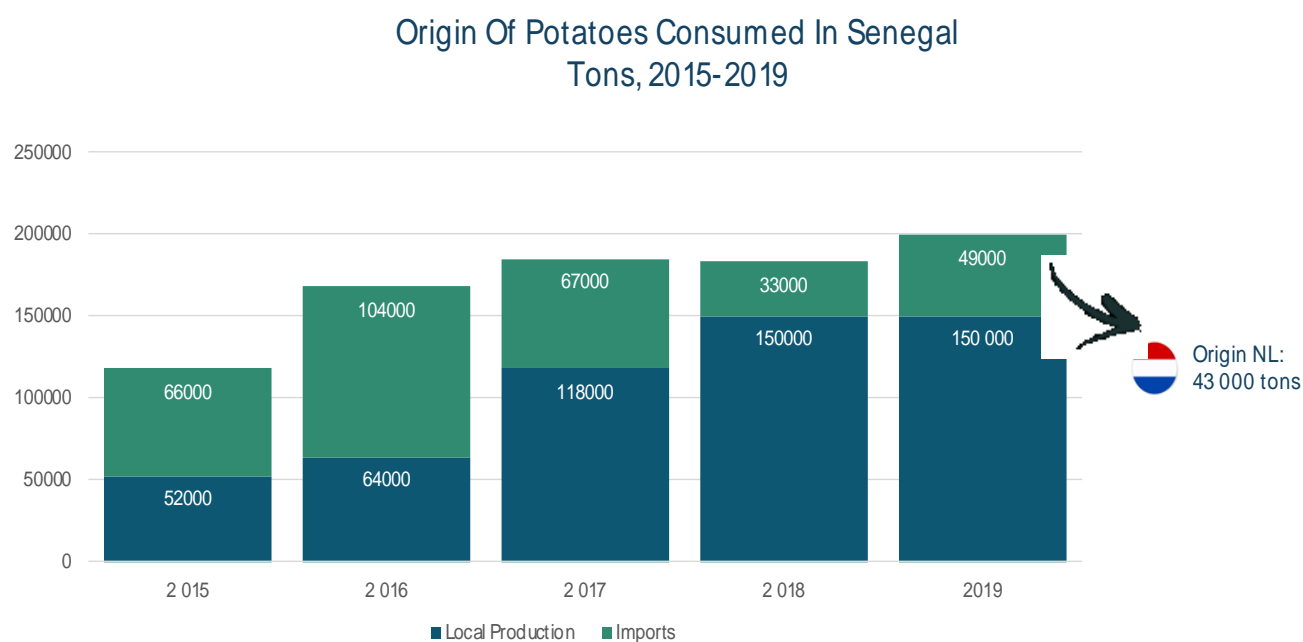


Most potatoes are consumed 'fresh' directly by consumers and restaurants and caterers. Larger potatoes tend to be distributed around the country, while baby potatoes are sold in the farming area. There is very limited processing, mainly potato crisp production on a small scale. Potatoes also play a small role in the food services sector, which in itself is still in the early stages of development. The first KFC arrived in Senegal in October 2019. In short, the market is still young and has a lot of space to develop.

The demand for potatoes is year-round, with a few peaks around key festivities such as Tabaski, Korité and Ramadan. In contrast, potatoes have a very limited production window. Potatoes require cool temperatures, which makes this a winter-spring crop in the Niayes. As a result, imports are required in the hot summer months. The quality of imported potatoes is seen as being somewhat better than that of local potatoes, largely because they can be stored for longer periods without rotting.

Strong import protections were put in place to stimulate local production. Import tariffs of 42% have been introduced and imports are only allowed when local producers are unable to supply the market. Typically, imports are allowed between July and January- roughly 8 weeks after the local late season crop has come to market. Local production has also been supported by heavy subsidies on potato seed.

Figure 39: Consumption, Import and Local Production of Potatoes in Senegal



Consequently, imports have decreased when compared to the highs experienced in 2015, 2016 and 2017. Currently Senegal produced an estimated 199,000 tons of potato, of which 150,000 (75%) is produced locally. Nearly 88% of the 49,000 potatoes consumed is imported from the Netherlands.

### 3.1 Regional Export Opportunity

Consumption of potatoes in West Africa is still low by global standards, but growing. To cater for this demand both local production and imports have increased. Figure 40 provides an overview of consumption and imports in the region.

Figure 40 Imports and Per Capita Consumption of Potatoes in West Africa

	2019	Share of Regional Potato Imports	Consumption per Capita 2015*
ECOWAS	143 000 tons		
Senegal	49000 tons	34%	7.4kg
Ivory Coast	39000 tons	27%	0.83 kg
Mali	21000 tons	15%	7.34 kg
Burkina Faso	9000 tons	6%	0.29 kg
Cape Verde Islands	8000 tons	6%	Unknown
Togo	2400 tons	2%	0.39 kg
Ghana	2200 tons	2%	0.140

\*Source: Helgi Library based on data from FAOSTAT

The leading importers of potatoes in the region are Senegal, the Ivory Coast and Mali, who import three quarters of the total imports of the region. The biggest supplier is the Netherlands, followed by France and Belgium. Minor volumes are imported from South Africa and Morocco. Morocco is the most recent supplier of potatoes to the region, with most of these going to Senegal.

Regional potato production has also been expanding. In 2019, ECOWAS imported 11500 tons of seed potato, nearly 4 times more than in 2015 (3359 tons). Mali, Nigeria and now Senegal also have developing potato seed multiplication. But production of potatoes in the region has limitations. They require a temperate climate for production, with noticeable differences between night and day time temperatures. The lower the temperature, the better the tubers grow and the lower the disease pressure. Potato is a very disease prone crop, and benefits from production in dry climates under irrigation. Whereas East Africa has more highland areas with temperate climates, these are very scarce in West Africa. Most areas have a combination of humidity with high temperatures day and night (coastal zones), or dryer climates but with extreme heat during the day (Sahel) and are thus not suitable. This presents a unique opportunity to Senegal, where cool temperatures in the Niayes region provide good growing conditions for potatoes in winter.

Across Africa and particularly West Africa there are very limited zones with the right conditions. Potatoes produced in those areas tend to be transported over vast distances to reach consumers. Nevertheless, Intra-regional trade in ECOWAS when it comes to potatoes is still relatively small when compared to imports from the EU. 2000 tons of potatoes were exported from Mali to Ivory Coast in 2019, which could be imported European potatoes. In contrast, the tight controls on the

import volumes with growing demand mean that Senegal exported a paltry 265 tons of potatoes to Ivory Coast and Mauritania combined in 2019<sup>7</sup>.

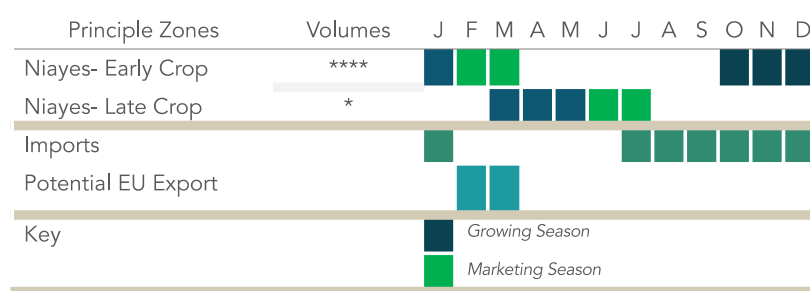
### 3.2 EU Export Opportunity

Export to the EU could constitute a market for Senegalese potato growers. The potatoes harvested in February could hit the shelves in Dutch supermarkets in March. This is when domestically stored stocks are running low and have been deteriorating in quality. Also, this would arrive 4-6 weeks before potatoes from Morocco and Egypt arrive. This would require experiments with different varieties to get the quality and timing right.

### 3.3 Overview of the Production, Marketing Season And Pricing

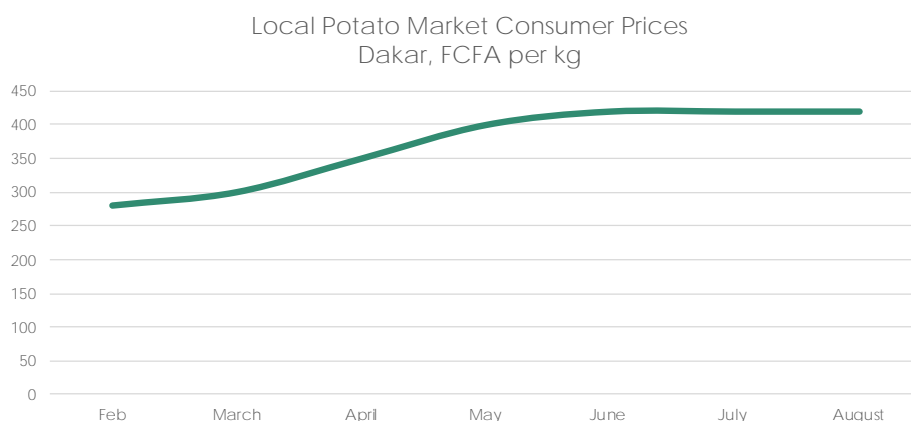
There are 2 potato growing cycles in the winter season. For the early season, potatoes are mostly planted from early October towards early November and marketed from late January until the end of March. In March the second growing seasons starts, and those potatoes are marketed in June and July. When they run out, the imports start until the new harvest in February of the following year. There is a small potential export window to the EU in February and March.

Figure 41: Overview of Sales Months and Export Seasons for Potato In Senegal



Consumer Market Prices of potatoes start at the season low in February (250-280 FCFA) . Then these price increases until a maximum is reached in June (420 FCFA). Finally, at the end of August the import ban is lifted, and potatoes are able to arrive from the EU.

Figure 42 Price of Local Market Potatoes - Dakar 2019



<sup>7</sup> Recorded exports from Senegal to Mauritania were substantial in 2018 , when 841 tons of potatoes were exported. But this seems to have been limited to that year. Source ITC Trade Map

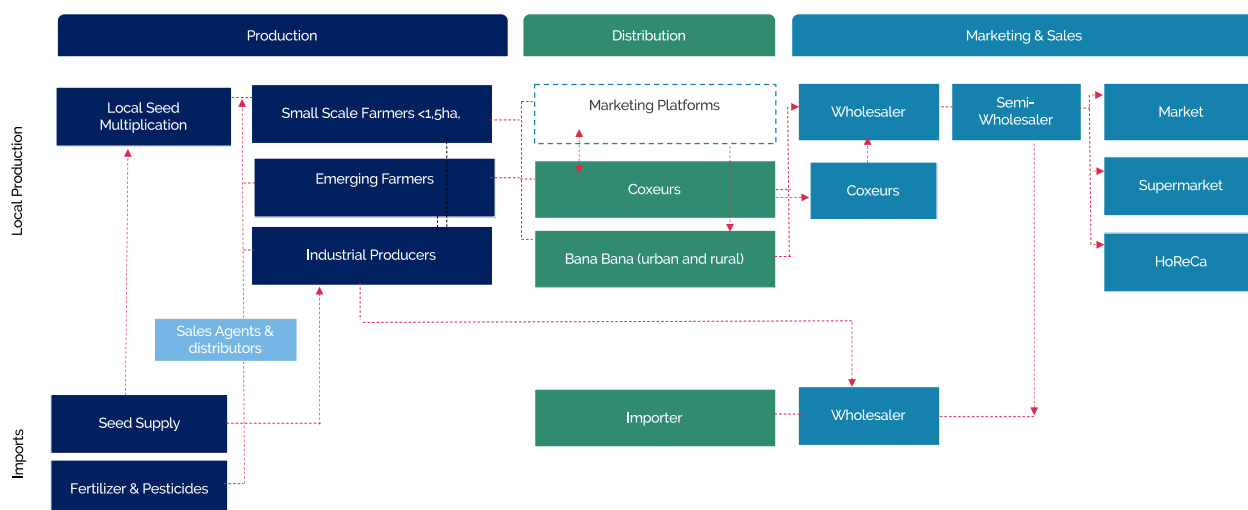
## 4 The Structure of the Value Chain

### 4.1 Overview of the Value Chain

Figure 43 provides an overview of the potato value chain in Senegal. Most inputs including seed are imported, though small quantity of seed is allegedly multiplied locally. There are 3 types of producers: small scale, emerging and industrial or large producers.

The complicated part is in the distribution. The two main actors are coxeurs and bana banas. Coxeurs are a type of marketing agent who is often connected to a specific production area where he/ she has his network of farmers. They don't tend to transport product or take ownership but receive a commission per kg. They act as a sort of co-ordinator of sales for either bana banas or wholesalers. Bana banas are more traditional traders who take ownership of the product and transport it. A small number of potatoes are now also traded via newly established marketing platforms and collection points. These are modelled after the onion chain. But this is a relatively new idea and still needs lots of development to be a major linkage in the chain.

Figure 43: Overview of the Potato Value Chain in Senegal



### 4.2 Production Locations and Yields

Potatoes are grown in the cooler North-East of Senegal and specifically, the Potou, Louga regions and presently a little further North in Mbane, on Lac du Guiers. Cooler temperatures in the dry winter months of 22-26°C create good conditions for potato production.

Growth in potato production volumes has come from an increase in the area under cultivation, as well as some smaller increases in yields. In 2010, 750 ha were being used for potato cultivation. Today that area has grown to 3356 ha. Nearly half of that area (1500 ha) is now farmed industrially in Mbane, which has become an important location for potato production.

This industrial production has allowed for a significant increase in yields in Senegal. Local small-scale producers, who still make up the vast majority of potato producers in the area, have yields that vary from 15-25 tons per ha. More advanced emerging farmers and industrial producers generally have yields of 25-30 tons per hectare depending on the variety of potatoes being farmed on a specific block. And the industrial producer Senegindia has achieved yields of 50 tons per ha on specific blocks in the previous production season. These yields are high for African standards,

where small scale farmers typically achieve yields of 5-10 tons, and emerging farmers 8-15 tons. In South Africa dry-land potato yields are around 35-40 tons per ha and irrigated yields are 45-60 tons per ha.

A number of French potato varieties are grown in the Niayes, including Spunta, Sahel, Defla, Saffron, Alaska, Loanne, Panela and Claustar. These are produced in 2- and on rare occasion 3- production cycles, starting in November. The first harvest is usually in February and March, with another production cycle usually beginning in April and completed in June. Figure 44 provides an overview of the months in which potato is marketed.

### 4.3 Type of Producers

#### 4.3.1 Large Industrial Producer

Senegindia, is the largest producer in Senegal and possibly has the largest potato farm in Africa by area. They produce >60 000 tons of table potatoes annually (40% of national production) under irrigation on about 1500 hectares. The water is drawn from Lac du Guiers, which in turn is fed by the Senegal River.

With better farming practices Senegindia targets the end of the growing season, or festivities, when prices are slightly higher. In part this is influenced by state policies to avoid competing with smaller local producers who are less flexible in when they can bring product to market. Senegindia thus relies heavily on storage. The installed capacity of storage at their facility is 40 000 tons (refrigerated and climate controlled), which allows them to store most of their crop for several months.

Senegindia has achieved an average yield of 25-30 tons/ha, with more recent peaks of up to 50 tons/ha in the 2019-2020 growing season with specific varieties. As a result, Senegal is potentially amongst the highest yielding potato growers in Africa after South Africa. Yields in South Africa are 35-40 tons for dryland farming and 60-70 tons per ha for irrigated farming. Yields in the Netherlands and Belgium for rainfed potatoes fluctuate between 40 and 65 tons per ha, depending on the variety and the weather.

In addition to their own production, they also engage contract farmers in an outgrower model. The producers purchase inputs from Senegindia. In some cases, this involves Senegindia providing prefinancing. Then at the end of the growing season they sell the potatoes back to Senegindia at the pre-arranged price. This offers the farmers some predictability around the sales price as well as quality inputs. But the farm gate price paid is close to the seasons' lower prices from the start of February.

Both emerging farmers and small-scale farmer cooperatives of various sizes take part in the contract system.



Figure 44 Overview of Financials of the Outgrower Model

Illustrative model of Senegindia's Outgrower model based on experience of a cooperative in the Niayes, 2019/2020 Season				
Cost of Inputs	Farm Gate Price	Cooperative Margin	Senegindia Purchase Price	Early Season open market Farm Gate Price
Pre-financed by Senegindia	200 FCFA	10 FCFA	210 FCFA	150-180 FCFA (early season) 300 FCFA (late season)

#### 4.3.2 Emerging Farmers

There are a few up and coming emerging commercial potato farmers. These farmers are typically more technologically enabled and have farms that are larger than those typically farmed by small-scale farmers. They use about 2-3 pivots per farm for irrigation and may borrow planters from Senegindia to allow for some degree of mechanisation. With access to good quality inputs, irrigation and some mechanisation, they are able to deliver a good quality potato to market and achieve good yields similar to Senegindia's historic 25-35 tons per hectare. Many of these farmers cooperate with Senegindia, or are a part of their contract farming system.

#### 4.3.3 Small Scale Farmers

Small scale farmers in the Niayes region typically have farms of less than 1ha. But some can be as large as 5ha. Typically, small scale producers have yields that range from 15 to 25 tons per ha, with the higher yields being reached on farms with good control of irrigation.

Potato is the main winter season crop for these farmers, alongside an assortment of vegetables such as cabbage, onions and carrots. Typically, 80% of the potato crop is grown in the first cycle between October and March. Thereafter, peanuts, onions or tomatoes would be grown under irrigation, or they could opt to close the winter growing season.

The rotation is guided by the market results from the previous year. If the previous year worked well for a crop, producers do it again. If not, then they change what they grow. There's also an element of "follow the leader" at play. Successful crops in one year get far more attention from more farmers in the next year. Prices then go down, which has the opposite effect.

Mechanisation is still unusual, albeit growing in usage. In general farming remains fairly manual or traditional farm equipment could be used. For example, planting, harvesting and even irrigation might be carried out by hand by hired labour (sourghas). When it comes to irrigation, which is required in the Niayes, flood or gravity irrigation (canals and diesel engines for pumping) is often used. This hampers their control over the growing conditions and increases disease spread.

Even on this small scale, potato farming is considered quite profitable, potentially more than onions. Indicative calculations suggest that small scale farmers are able to achieve roughly a 50% gross margin, which is significantly higher than that for onions (20% GM). This is consistent with

our experiences in other countries, which have shown that those farmers who can manage diseases reasonably well and use good seed are very profitable.

At harvest these farmers employ migrant labour (soughas) who come from Mali, Mauritania or poorer parts of Senegal. This labour then helps to bring in the harvest. Bagging of the potatoes generally occurs at the farm unless the farmer is a part of a cooperative. In that case the potatoes are taken to a central location for sorting and bagging. Farmers usually use 25kg mesh bags. Most harvesting is done manually, which tends to reduce yields because not all potatoes are uprooted and harvested.

## 4.4 Input Supply

### 4.4.1 Importance and Characteristics of Seed Potato

Potato is a unique crop in a sense that the quality of the seed (the seed potato) has an unusually large effect on yields and diseases and final product quality. The cost of good seed potato is usually 40% to 50% of all input costs, despite potato requiring multiple rounds of preventative spraying and fertilising.

Furthermore, there is an enormous amount of potato varieties that differ in:

- Shape (round and oval, small and large).
- Cooking characteristics (Firm versus mealy or floury).
- Skin colour (red versus yellow).
- Flesh or inside colour (White to yellow).
- Sugar content.
- Potential Usage as a result of the characteristics (fresh table, mash, starch production, frozen chips, crisps, dehydrated) as well as the growing conditions.
- Storage period (how well and long can it be stored), and related to this the dormancy period (how long can the seed potato be stored before it starts sprouting).

One typical seed potato firm will market more than 50 varieties.

Good seed potato can be used for 3 years, meaning that for 3 years potatoes from the harvest can be kept aside for the next crop. Many commercial farmers will buy a certain amount of seed every year to refresh the seed stock that is now 3 years old.

However, whether seed can be properly re-used depends on the climate, the storage conditions and the dormancy period of the variety. For example, in the Kenyan or Cameroonian highlands farmers can farm 2 to 3 seasons, and the climate is temperate. Farmers can relatively easily store potato in a diffused light store (dark traditional storage with good ventilation), for 2-4 months until a next season starts.

But in Senegal re-using seed would require storage for up to 9 months in hot weather until the next season, which is not easy. It needs to be stored at temperatures from 1°C - 4°C to avoid early sprouting. The cost involved may well make it cheaper to just import new seed.

### 4.4.2 Oversight & Regulation

Potato seed falls under the control and legislation designed for seed, such as maize, rice and onion. As such, multiplication of potato seed is overseen by the Seed Division (DISEM) who is



responsible for issuing permits to import and multiply seed. At the regional level field checks are tasked to the Regional Directorate for Rural Development.

Seed research and development is managed by the Centre for Horticultural Development (CDH) from the Senegalese Research Institute (ISRA). Finally, imports are regulated by the Directorate for Vegetable protection, who tasked to ensure that seed entering the country is free from disease and is in a good condition for sale.

In the past new varieties were studied by the state research institute, ISRA, before being approved and disseminated by them. Now producers, especially larger ones, import seed directly. They then carry out their own field tests, applying for authorization from DISEM.

#### 4.4.3 Formal Seed Provision

Because it is nearly impossible to keep potato for a year to use as seed without cold stores, farmers, irrespective of the scale of production, rely on seed from the private sector. When it comes to small producers, seed is supplied under the state subsidised seed program, which allows farmers to purchase seed for 50% less than the market price. In 2018 this program provided an estimated 10 444 tons of potato seed to small scale producers. However, even this seed is made available via commercial enterprises, who import the seed from France.

Figure 45 Average Market Price of seed potato

Potato Seed, 28/ 55	
Retail Price (Import)	680 FCFA/ kg
Subsidised Retail Price (Local)	340 FCFA/ kg

Seed potatoes is sourced primarily from 2 French firms, Germicopa and Copec<sup>8</sup>. A far smaller volume comes from India, Egypt and the Netherlands. Figure 46 provides an overview. In a clever move, Germicopa distributes through one of the more active market gardening professional associations in the Niayes, AUMN.

In general Senegalese shoppers prefer larger sizes of potatoes (consumer research). But producers prefer smaller production sizes, which allow them to pack potatoes more densely per ha. Larger potatoes generally ask for more mechanization for harvest. But this also means wider spacing between the rows in Senegal. However, for mechanical harvesting and spraying, tractors can be fitted with narrow tyres to allow for narrow spacing. Local professional association AUMN for example advises small scale farmers to plant with a 50cm distance between rows.

Figure 46 Main Sources Of Imported Seed Potato In Senegal In 2018

	Volumes 2018	Share of Potato Seed Imports
<b>Total Imports</b>	<b>8 100 tons</b>	
France	6 000 tons	74%
India	676 tons	8%
Egypt	487 tons	6%
Netherlands	206 tons	2.5%

Well known seed suppliers in Senegal are Tropicasem, UPGM de Mboro (importing seed potatoes), AUMN (Association des Unions Maraîcher des Niayes) and Germikopa. Senegindia, who are a large importer of potato seed, supplies seed to contract farmers in their system.

More recently, Senegindia have been making steps towards local certified seed multiplication. But as this is still in the early stages that at present reserve a portion of the harvest, which will be used as seed in the next growing season. To keep the potato seed dormant, they use modern technologically advanced climate-controlled cold-storage facilities. This enables them to reduce the potato seed tubers they're required to import each year with two thirds.

ISRA has attempted local potato seed multiplication. Technically this is possible in climates with temperatures below 20°C and humidity below 30%-40%. The project faced a few challenges. Firstly, a virus attacked the seed which resulted in poor productivity rates. As second challenge is the cost of cold storage. The seed produced in January, February, March is required to be stored & kept dormant until planting in October. But an unstable electricity supply means that this is challenging and potentially costly. Local potato seed multiplication is yet to be successfully carried out. Yet, with 50% subsidies on seed, it would seem to be potentially beneficial to the state as well as offering some export opportunities.

#### 4.4.4 Fertiliser & Pest Control Products

Fertiliser and pest control products are all readily available in Senegal via a privatised model of import and distribution. However, there is state subsidy of 50% on fertiliser for specific food security related crops like rice, maize and sorghum, but not potato.

Phosphate, which is critical ingredient in fertiliser production, is mined in Senegal. However, privatisation of ICSCHEM, the state-owned company responsible for producing fertiliser has resulted in this key mineral largely being exported to India, Iran and Japan. This focus on export of the primary commodity has resulted in a decreased blending capacity for fertilisers. Only 1 company blends fertilisers in Senegal on a limited scale. Consequently, commercial fertiliser is largely imported in pre-packaged bags.

This reliance on international suppliers means that standardised variations of NPK, DAP and Urea are readily available, but not specific blends for specific crops and areas. Some imported fertiliser comes from regional blending plants in Ghana and Ivory Coast. Commercial farmers in this region use DAP and NPK as well as potassium as fertiliser, as well as various pesticides to control disease.

Two types of importers compete in Senegal. Firstly, those that participate in the state subsidised fertiliser system e.g., Agriphytex. And secondly, those that are not allowed to participate e.g., La Cigogne.

Importers engaged in the subsidy program retail unsubsidised fertiliser directly to producers of potatoes. While the ones outside of the system market their products via independent agricultural supply retailers, who generally travel to Dakar to purchase and collect product. Increasing competition has led some companies to develop more defined business relationships. For example, they are offered wholesale pricing, delivery, area exclusivity agreements, technical training etc. Nevertheless, the enhanced- some would say unfair-competitiveness of the companies in the subsidised program means that most importers tend to prioritise pest control products over fertilisers.



From experiences across Africa, we know the fertiliser subsidies can have positive and negative effects. The positive effects are that it stimulates the usage of fertiliser and thereby boosts yields significantly. Small farmers particularly across Africa have a tendency to only use 1/3<sup>rd</sup> to ½ of the recommended dose because of a lack of funds, but this reduces the yields and profitability significantly. Negative effects that are observed, are:

- substandard quality of fertiliser, because governments rarely check the quality and farmers are less critical of free or subsidised fertiliser.
- Crowding out of the private sector, if only certain importers are selected for the scheme, as well as animal manure.
- Diversion of fertiliser intended for priority crops to non-priority crops, which in turn hampers the development of crop specific mixes.
- Late application of fertiliser because of late fertiliser distribution.

Finally, farmers also source animal waste (livestock, poultry and food compost) for use in potato production. A 50-kilogram (kg) bag of organic livestock- based fertilizer costs about 650 FCFA<sup>9</sup> (while poultry-based fertilizer costs 1,750 FCFA<sup>9</sup>).


Figure 47 Cost of Fertiliser- Industrially Produced and Local Organic Fertilisers

NPK (10kg bag)	DAP (10kg bag)	Poultry (50kg bag)	Animal Livestock (50kg bag)	Compost (Casuarina tree) per wagon
1200	1400	1750	650	2000
These are typically used in potato production with cooperatives				

#### 4.5 Route to Market

Imported and locally produced potatoes are available on the Senegalese market- albeit at different times of the year. Generally, imported potatoes are more expensive and their storability is better.

Figure 48, Average Market Price of Potatoes



Retail Price (Import)	600 FCFA /kg
Retail Price (local)	350-450 FCFA /kg
Farm Gate Price (late season)	320-325 FCFA /kg
Farm Gate Price (early season)	150-180 FCFA /kg

Potatoes produced by small scale farmers in Senegal make their way to the markets around the country by a fairly developed system that involves traders, agents, wholesalers and finally retailers. Marketing platforms are in the initial stages of planning. This system stretches across the country making potatoes produced in the Niayes available in the local rural markets and urban centres.

Imported potatoes, have a shorter, more direct route with fewer actors involved in the chain. They are sold by importers to wholesalers, who then sell to retailers and the HoReCa sector. Finally, baby potatoes, tend to be sold on the local market near farms.

<sup>9</sup> These get used in different ratios, so the application rates would need to be taken in to consideration to calculate the costs per hectare

#### 4.5.1 Traders (Bana Bana's) & Coxeurs

As with many African value chains traders play a critical role in getting produce from the fields to the markets. They purchase potatoes field-side, or at established marketing platforms. They then transport these to wholesalers in markets where the potatoes will be sold. These traders are generally well informed and help to connect the consumer and producer markets. Some large producers sometimes act as collectors themselves collecting potatoes from smaller producers and marketing these. As a result, Bana Banas focus on either rural or urban markets.

Commissioned agents often play an important part in marketing produce for farmers. These are known as coxeurs. In some cases, coxeurs are simply farmers who are connected and skilled enough for the job. In return they receive a fee per bag of produce sold.

On the market end, they are also sometimes tasked with sourcing product for a specific market. This could mean that the Bana-Bana will work with coxeurs in the Niayes to purchase his stock. And then he could travel to Dakar where he will work with a coxeur to sell his stock to wholesalers.

#### 4.5.2 Marketing Platforms

Marketing platforms were developed in the onion sector to facilitate the seamless marketing of that product. This is a new idea for the less organised potato sector. In the case of onions, a variety of charges are levied to the farmers for being able to use the marketing platform. This will ostensibly be the model for potatoes when this idea is fully realised. At the moment some collection points exist with the idea to either expand on these or to combine onion and potato marketing platforms. As a result, a model of the costs levied at the onion marketing platforms is supplied below.

Figure 49 Illustrative Fee Based on the Onion Marketing Platform Fees In Poutou

Fees And Taxes Levied At Onion Marketing Platforms					
	Taxes	Handling	Weighing	Sorting	Coxeur
Fee per 50kg bag	50 FCFA	50 FCFA	50 FCFA	200 FCFA	100 FCFA

#### 4.5.3 Importers

Importers in Senegal tend to import a variety of products at different times of the year. This means that one importer could be involved in the import of potatoes and onions. Though there are more than 50 importers, 10 are responsible for 80% of imports. This is especially true as the import of potatoes is well controlled like onions. Each year the Market Regulation Agency (ARM) works with the sector to determine the trade window as well as the volumes of potatoes that will be allowed in to the country, and assigns quotas to importers. 50% of the quota is determined by the previous year's market share in the imported potato market. 50% is based on the volume of local potatoes purchased in the previous year. This in turn means that importers are forced to participate in the local market. They do this by working closely with large wholesalers of onions and potatoes. This is also the route for onions from industrial producers, enabling the importers to reach their local volumes numbers without too much effort. Importers tend to market imported potatoes to wholesalers and semi-wholesalers in Dakar. These then pack the onions in to suitable bag sizes before selling these on to retailers.

## 4.6 Indirect Actors in the Potato Supply Chain

The potatoes value chain is fairly organized in Senegal. As a result, a variety of indirect actors play (potentially) in its operations.

### 4.6.1 Market Regulation

Various measures have been introduced to encourage the development of local production. Firstly, **tariffs of 42%** were introduced on imported potatoes. Secondly, a **temporary annual import ban** was put in place, allowing potatoes to be imported in a window when local producers are not able to supply the market. Typically, this is from July to January, although the exact timing is determined by a steering committee of actors in the value chain as well as regulatory authorities. To prevent importers from ordering large surplus volumes during the import window, a **quota system** was introduced. Finally, ARM consults with various actors in the chain to set **recommended selling prices**- farm gate and in Dakar. However, as these are only recommended prices, actual prices vary a fair deal. In reality producers typically receive lower prices at peak production period, while consumers pay higher ones.

### 4.6.2 Professional Organisations

Professional organisations are a common feature of the agricultural sector. Various cooperative unions, producer federations, groups and associations all work in some way to organise farmers at the local, regional and national level.

In the **Niayes the Association of Maraîchères des Niayes Unions (AUMN)**, from 2001) was created to support quality management, access to water and professionalization in their representation. It is very active in organizing the producers in the Niayes for a variety of crops. In the specific case of potatoes, they play an important role in providing imported potato seed.

At a local level, a few active producer associations work in the potato sector (amongst other crops). These are Book Ligueye Notto Gouye in Diamma; APMK Association des Producteurs Maraîchers de Kayar; GIE des Producteurs Maraîchers de Kayar; Association des Producteurs Maraîchers de Fass Boye.

### 4.6.3 Banks and Microfinance Organisations

In theory, potato farmers are able to access financing through the Banque Agricole. In reality most farmers who are not able to self-finance, get financing from personal networks. Where they are interested in pursuing financing from the banking system then tend to turn to micro-finance organisations. PAMECAS, the Union Financière Mutualiste, LBA, UIMCEC, Credit Mutuel du Senegal, are some of the MFI's extending loan products to small scale farmers.

These institutions offer unsecured lending, at 16% interest per year with a payback period of 3 years for investments in equipment or working capital for inputs. The growing popularity of solar irrigation- and the fact that it makes good business sense- means that this has become an important area of activity for these MFI's. These MFI's tend to work with the input and equipment suppliers, who provide interest free loans to the MFI's. They in turn conduct an assessment of the producers' credit needs, provide advice and conduct an assessment of the general credit worthiness of the recipients.

The MFI's are also able to access funding from the Priority Investment Guarantee Fund (FONGIP).

### 4.6.4 Input Supplier Financing



Input and equipment suppliers have been playing an increasingly more important role in financing of inputs and of equipment. As mentioned earlier, Senegindia provides pre-financing of inputs for farmers in their “contract system”. A novel approach from solar irrigation suppliers involves them providing interest free loans to MFI’s. They then extend credit to producers at 16% interest rates. This is an important driver of recent growth in access to mechanised irrigation equipment.

#### 4.6.5 Agricultural Insurance in Senegal

Agricultural insurance been developed fairly recently in Senegal. The National Agricultural Insurance Company of Senegal offers a variety of insurance products in all agricultural sectors with the exception of livestock and fishing. Risks of crop failure due to flooding or (index insurance), to damage caused by birds, wildlife, etc. are some areas that are covered.

There are no specific products developed for potato producers and in general they’re unaware of products that might be available.

### 4.7 The Knowledge Sector

Knowledge and skills development are two important supporting activities in the agricultural sector. A sound structure would have a good combination of proactive research and development, which is then enriched and disseminated to professional education, vocational training and extension services.

#### 4.7.1 Research and Development & Professional Skills Development

Agricultural research and development falls under the remit of the Senegal Institute of Agricultural Research (ISRA). It falls under the Ministry of Agriculture and Rural Equipment’s (MAER) but operates as an autonomous unit. The Institute of Food Technology and the Universities of Dakar, Thiès, Saint Louis and Ziguinchor all contribute to knowledge development in the sector. Some private companies are also involved in research. For example, Tropicasem conducts applied research. This involves testing whether the available seed performs in the Senegalese environment.

The local knowledge developers listed above also work alongside international actors. For example, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) of the CGIAR and advanced research institutes and universities in Europe (e.g., the Institute for Research on Development, France) and North America (e.g., University of Florida). How active they are in potatoes would need to be explored further.

#### 4.7.2 Extension Services

Typically, extension serviced in the developing world are delivered by a combination of the state, the private sector input and equipment suppliers and NGOs or donor partners. A framework for extension services exists in Senegal. But activity is focussed on the core food crops such as grains and groundnuts and to some extent onions. Potatoes have attracted far less support from the state.

From the private sector, there’s very little activity in providing knowledge around pesticides, seed, fertilisers etc. This is partly because of the structure of the system and partly because of low skills development. To better understand the framework provided by the state a short explanation is provided below.





Extension Services are designed to be coordinated and developed by **ANCAR**. This state funded agency has extension staff in each of Senegal's 45 districts and 190 counties. However, a chronic shortage of funds means that there's been a high vacancy rate in the organisation since 2017. To support ANCAR, Special Regional Development Agencies (**SRDR's**) were established by the government. They operate in particular zones and on particular theme. For example, the Senegal River Development Agency (**SAED**) was created in in the Senegal River Valley to support the development of irrigated agriculture there. The Agency's advisory service employs 85 field extension staff equipped with motorbikes and 12 supervisors, who have four-wheel drive vehicles. Extension activities include participatory diagnosis, needs assessment, implementing activities and monitoring and evaluation. SAED receives funding from the government and is currently managing seven donor- financed projects funded by the African Development Bank, the French Development Agency, the Japanese International Cooperation Agency, the Korea International Cooperation Agency, the Kuwait Fund, the Saudi Fund for Development and the World Bank. Another relevant agency is **ANIDA**. Founded in 2006, the National Agency for Agricultural Employment and Development is tasked with creating large, modern farms in "community agricultural domains," primarily to serve as employment opportunities for rural youth and to promote agricultural development. Twelve such domains are in operation and include over 100 farms. ANIDA employs 70 extension agents, who are supervised by 12 extension managers. Donors include the African Development Bank and the governments of Senegal, Spain and Brazil. In addition to extension services, these organizations provide a range of support including infrastructural development and supply of inputs.

Some professional and cooperative organisations provide training for their members. For example, RESOPP, a federation of farmer cooperatives, offers training services to its member cooperatives as well as non-members. They have training facilities in 8 out of the 15 regions of Senegal.

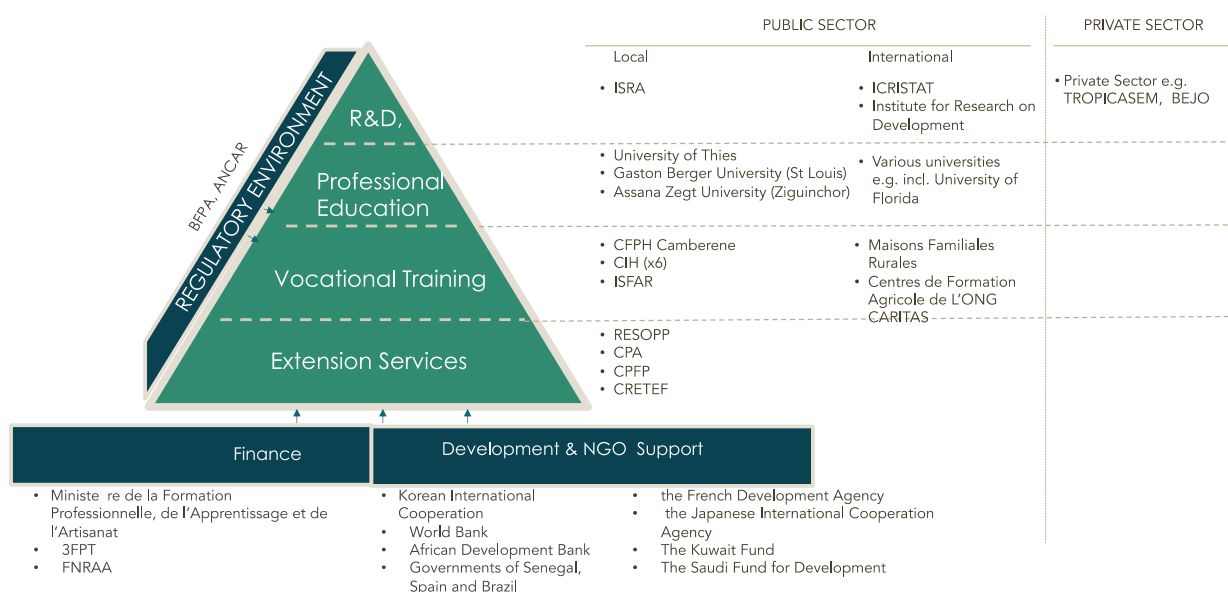
Centre Polyvalents de Formation des Producteurs (**CPFP**) & the Centres Régionaux de Formation Technique et Professionnelle, (**CRETEF**) provide training on agricultural techniques and innovative techniques for farming amongst other topics. These are targeted at producers.

Specially for potatoes, the biggest gains have been made thanks to support from PADEN. The potato program focussed specifically on extending the use of irrigation and improvements to irrigation techniques. This is credited with helping larger more advanced farms from making the increase in yields from 15 tons per ha to 30 tons per ha (or something in between).

The state department for agricultural research ISRA, provides some guidance around planting of potatoes in the Niayes. And additional support is provided from seed suppliers. However, this is far less than is required of a crop that benefits from technology and precision techniques.



Figure 50 Overview of Knowledge and Skills Development Actors in Senegal



### 4.7.3 Finance (Agricultural Knowledge Sector)

Financing of skills development and research and development related to agriculture is provided by the National Agro-Food Research Fund of Senegal. This is a government agency established in 2004 that mostly funds research but has recently started funding dissemination of knowledge. The National Fund for Agro-Sylvo Pastoral Development (FNDASP) provides funding to support for the dissemination and large-scale adoption of technologies. They also fund projects that will expand the availability of certified seeds for priority sectors by promoting sustainable seed systems. Finally, bilateral and unilateral donor agencies such as the World Bank provide financing within specific programs e.g. The World Bank funded West African productivity program.

### 4.7.4 Advisory and Training Policy Environment

The Bureau for Professional Agricultural Training (**BFPA**) is a service department of the ministry of Agriculture. They are responsible for coordinating agricultural and rural training policy in Senegal. Their ambition is to provide education to especially the rural population of Senegal by supporting and coordinating initiatives that improve agricultural education.

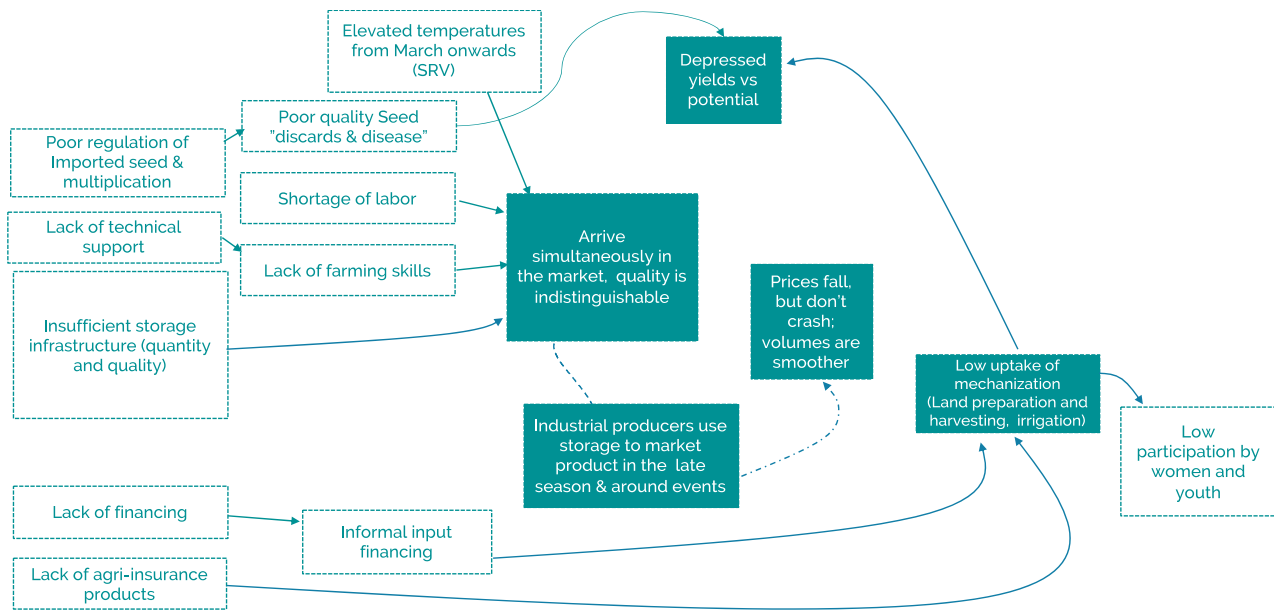
**ANCAR** is parastatal that was formed in 1997 and given the role of providing advisory services throughout the country. ANCAR's mission is to provide a national system of rural and agricultural advisory services through improving advisory service delivery, harmonizing advisory methods, and facilitating a network of public and private advisory services. While the hope was that state funding would diminish over time, in reality it remains largely public sector funded organisation. In addition to providing advisory services, they also are to link farmers to the providers of inputs, credit, marketing and processing services.

## 5 Issues and Opportunities Along the Value Chain

Figure 51 reviews the most important issues along the value chain. These are discussed in the following sections.



Figure 51: Overview of the Main Issues and its Effects on the Value Chain



## 5.1 Unreliable Seed Arrival, Quality & Disease

There's a defined policy framework for seed imports and multiplication in Senegal. Producers are allowed to import seed. However, DISEM provides authorization for seed multiplication after an importer has demonstrated that the variety meets acceptable standards. Typically, these include fairly basic demonstration plots rather than more thorough research into the suitability of the seed to withstand specific local conditions such as increasing salinity. Also, while the Directorate of Vegetable Protection (DPV) ensures that the imported seed is healthy i.e., free from rot; it doesn't ensure that the seed is qualitatively good i.e., has good germination rates.

Thereafter, the framework allows for seed multiplication to be controlled. Yet again, small budgets and low capacity prevent DISEM from providing any real regulatory control over the sector. They tend to delegate checks to the regional authorities, who lack resources to conduct field checks.

Improvements to seed and ongoing research and development are important components to a dynamic, responsive seed system. Yet, uncertain protection of the seed rights in Senegal has resulted in established international seed producers abandoning local seed programs and other avoiding supplying potato seed to this country.

A short production season means that for many farmers the planting window is relatively small. However, potato seed often doesn't arrive on time. This could be driven by delays in the harvesting of seed in the EU, which is typically done in July or August, and shipping delays. A second issue is the quality of the seed. Local producers view the seed being sent as "discards" from European production. In reality potato seed prices, the quality of that seed and patent protections are all interconnected.

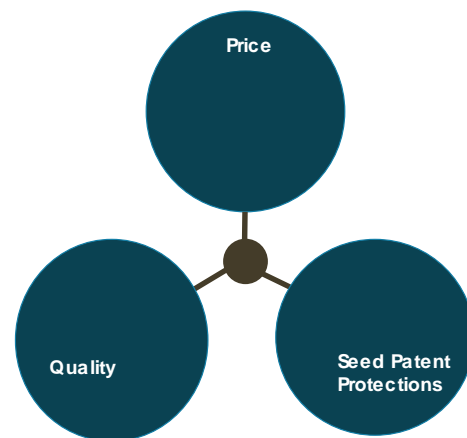
First newly developed certified seed is more costly than older seed varieties. In general, the benefits of new research and development is costed in to the sales prices. Secondly, the developers of that seed or tuber are very protective of their costly intellectual property. However, once the seed is used it is difficult to stop people from multiplying it without paying royalties (breeder rights).

Breeders of new varieties tend to deal with countries that have poor protection of breeders' rights in four different ways:

- They don't sell seed potato at all to these markets.
- They only sell older varieties.
- They sell seed at a much higher price, to compensate for illegal multiplication. They price the loss of royalties into the sales price.
- They only sell seed that cannot be multiplied further without degenerating.

Countries with more robust protections for seed patents, are able to access more recently developed seed, and even establish strategic partnerships with breeders for local multiplication.

Figure 52 Potato Seed Price- Quality- Seed Patent Protections Dynamic



Finally, imported potato seed in some instances have introduced diseases to local fields. This is supposed to be "weeded out" by the regulatory authorities during the import permit process.

As a result, it would seem that there's a good case for local commercial potato seed production. This seems technically possible from an agro-ecological perspective. Potato seed requires temperatures below 20°C and humidity below 30%-40%. It does however require tight control over diseases, especially where this is tuber production, a good use of new technology and a strong regulatory environment. It also requires strong laboratory services to be able to track and diagnose diseases as they develop so that remedial action can swiftly be taken.

The key challenge however is the storage of the seed over a 9 month period. A variety is needed that can be stored long, and the production and storage cost have to be compared to the cost of importing seed. However, if the reliability of the delivery is a problem, local production could solve this.

#### 5.1.1 Under-Resourced Plant Protection Agencies (DPV & DISEM)

The agencies responsible for the quality of seed in Senegal are hampered by a lack of resources. They have too few people and too small a budget to ensure that reliable seed quality control is possible. As a result, they lack quality laboratory infrastructure to be able to carry out rigorous testing. In the case of local seed multiplication- which occurs especially for other cereal crops- they lack the infrastructure for a track and trace system. Tackling these issues would provide some defence against deteriorating seed quality and the import and distribution of poor quality or fake seed.

#### 5.1.2 Poor Farming Practices

At harvest time 80 working day equivalents are typically required to harvest 1 ha of potatoes. Most farmers aim to get this job done quickly and in some cases find it challenging to find this labour. There's a lot of competition in this region for labour from small scale farmers of various crops and industrial vegetable farms. The migrant labour used on these farms, the sourghas, are

themselves under time pressure as they need to return home to prepare their own fields. Mechanisation is a helpful tool to ensure that farmers are able to harvest quickly, especially should production be expanded. In our experience a lot of potatoes are left in the field after manual harvesting; in some countries up to 30%. This is not only a financial loss but also increases disease pressure, even for farmers who rotate land.

## 5.2 Yield Improvements & Mechanisation Services

Small scale farmers without irrigation have been left behind in terms of yields. They achieve up to half the yields of larger more established farms. On the other hand, improved techniques, mechanisation and quality inputs have allowed Senegindia 25% higher yields. This yield gap would provide a major improvement to the livelihoods of these farmers. It will however require an expansion of mechanised irrigation, improved farming techniques and mechanised land preparation and harvesting.

Mechanisation for potato farming is important for 2 reasons:

- Potato is a precision crop, and mechanised land preparation, planting and harvesting is much more precise and leads to better yields.
- Potato is very labour intensive, and usually the amount of labour available determines how much land can be farmed.

Unlike popular belief, mechanisation usually does not lead to cost savings. But it does improve profitability and revenue through higher yields and a larger area farmed.

Large farmers currently have their own tractors and implements, but for small farmers this is not feasible. It takes about 30ha of land to make operate a tractor with implements economically.

Across Africa and much of the developing world the government has tried to develop public mechanisation services, but these have almost always failed because of bad business management. A typical public owned mechanisation services has at best only 50% of its fleet operational. A mechanisation service is a fairly complicated business that requires skilled and responsible drivers, good sales and work planning skills, and skilled mechanics doing weekly maintenance and repairs. In our experience we have seen four different private models that can work:

- The nucleus farmer model, where an emerging farmer with 10-20 ha wants to mechanise, and provides services to his/ her neighbour in his spare time in order to utilise excess capacity of the tractor.
- The owner operated service, where the owner drives the tractor while a family member goes out to sell services and plan the work simultaneously. In some countries these tractors migrate to follow the season across the country.
- A private mechanisation business with multiple tractors and implements employing drivers, mechanics and sales people and planners.
- Processors or large farmer – aggregators with outgrower schemes who service farmers in their scheme.

It would be interesting to explore these models in the Senegalese potato sector context.

## 5.3 The Storage Conundrum

From the perspective of the system there are real benefits to storage development. Around the world this has been a critical step to the development of a consistent supply chain. It's also critical



in potatoes to being able to hold tubers over from season to season, or to developing a local potato seed (tuber) production. Potato prices at the start of the season when the bulk of the farmers harvest. Throughout the season they increase with 77% over a 4 month period.

Storage has been a hot topic in the onion and more recently for the potato chain. As a result, several efforts have been made to expand storage capacity. These projects involve different models ranging from informal community/ village level stores, improved development aid financed storage – which might have better construction and ventilation; as well as commercial, cold storage and climate-controlled models. Quality, climate-controlled storage is now available in Dakar for 27 FCFA per kg of onions or potatoes per month. A warehouse receipts system is also being developed that aims to incentivise greater use of storage.

From a technical perspective, potatoes can be stored with low loss rates (<5%). But this does rely on storing quality potatoes suitable for storage. Getting good control of inputs and farming practices is an essential ingredient to this model working. However, given that the cost of storage is 26 FCFA per month and the average increase in the wholesale price is FCFA 41,25 per month over 4 months, the margins are not exceptional for everyone. It depends on storage losses and the cost of storage. Figure 53 provides different storage scenarios for a farmer who can choose to sell his potato to a trader at 165CFA, or put them in rented storage.

Figure 53 Profitability of Potato Storage by Farmers

Purchase		Sale		Storage duration	Gross margin	Potato quality	Storage Loss	Storage type	Storage cost	Financing cost	Profit		
165	Feb	200	March	1	35	bad	10%	20	traditional	13	1,65	0,35	0%
165	Feb	250	April	2	85	bad	20%	50	traditional	26	3,30	5,7	3%
165	Feb	300	May	3	135	bad	30%	90	traditional	39	4,95	1,05	1%
165	Feb	320	June	4	155	bad	40%	128	traditional	52	6,60	-31,6	-19%
200	March	300	May	2	100	bad	20%	60	traditional	26	4,00	10	5%
165	Feb	200	March	1	35	bad	3%	7	high tech	26	1,65	0,683	0%
165	Feb	250	April	2	85	bad	7%	17	high tech	52	3,30	13,03	8%
165	Feb	300	May	3	135	bad	10%	30	high tech	78	4,95	22,05	13%
165	Feb	320	June	4	155	bad	13%	42,6667	high tech	104	6,60	1,733	1%
165	Feb	200	March	1	35	good	5%	10	traditional	13	1,65	10,35	6%
165	Feb	250	April	2	85	good	10%	25	traditional	26	3,30	30,7	19%
165	Feb	300	May	3	135	good	15%	45	traditional	39	4,95	46,05	28%
165	Feb	320	June	4	155	good	20%	64	traditional	52	6,60	32,4	20%
165	March	320	June	3	155	good	15%	48	traditional	39	4,95	63,05	38%
165	Feb	200	March	1	35	good	1%	2	high tech	26	1,65	5,35	3%
165	Feb	250	April	2	85	good	2%	5	high tech	52	3,30	24,7	15%
165	Feb	300	May	3	135	good	3%	9	high tech	78	4,95	43,05	26%
165	Feb	320	June	4	155	good	5%	16	high tech	104	6,60	28,4	17%

For our calculations we have assumed the cost of traditional storage to be half of that of high-tech storage, and the financing cost to be 1% per month.

The maximum profit to be made is 38%, for high quality potatoes stored for 3 months in a traditional storage with 15% loss. A farmer doing the same in a high-tech storage achieves only 26% because the lower loss rate does not outweigh the higher cost of storage. However, we expect poor quality potatoes in traditional storage to have too much loss to make storage profitable while putting poor quality potatoes in expensive storage is also not that profitable. Though there does seem to be a case for storage of better-quality potatoes, one has to keep in



mind that there are also risks involved. Losses can be higher, prices can come down, product can be stolen etc.

#### 5.4 Regional and EU Export For Potatoes

There may be a small opportunity to export potatoes to the EU in February and March as a premium new season/ fresh potato. However, prices in Senegal are much more attractive than those in the bulk-market in the EU. Prices in February can fluctuate between 30 and 250euro per ton, depending on how good the yields were. This is much lower than the 180CFA (250euro) farmers can receive farm gate in Senegal.

There is most certainly an opportunity for regional potatoes as consumption is increasing but the number of areas where potatoes can be grown in West Africa is limited. Senegal has a much higher yield per ton and should be competitive with other growers. However, the opportunity will be limited to countries import bans or import duties for EU potatoes which are cheaper than current Senegalese prices. However, as the industry grows and domestic prices and margins come down to more realistic levels, it may be attractive to sell in neighbouring countries.

#### 5.5 Salinisation & Water Use

Irrigation is an essential component of potato production in the Niayes. Over time these irrigated and fertilised soils create seepage of minerals into the precious groundwater. In the hot summer months, some farmers leave their land fallow, preferring to wait for cooler temperatures. But this draws water up from the groundwater table and further increases salinity of the soil. Even with clever selection of seed, there's a limit to what is possible for successful cultivation in saline environments.

This issue is especially critical in the Niayes region, where the underground water reserves being used for agricultural purposes feed the city of Dakar, or where city water is being used to irrigate crops.

This scarce resource requires better management. Firstly, to ensure that farms use only the least amount of water possible for successful cultivation. Secondly, some planning is needed for summer crops to keep the land in use. Finally, a longer-term planning is required to ensure that water resources are used sensibly. Without well thought through water and land management continued salinisation can be expected.

#### 5.6 Access to Finance

Large banks in general focus their services on large business. This is driven both by high administration fees for small loan sizes as well as a weak service footprint in areas traditionally suited to small scale farming.

Micro-finance institutions appear to be far more active in the potato chain. They offer products that are better suited for providing for the smaller loans needed to finance irrigation equipment as well as working capital for inputs. The Senegalese are however "bank-shy" when it comes to credit. Generally, they prefer to rely on personal networks and self-financing to fund their activities. This also helps them to avoid the unanticipated risks related to weather. The low availability and uptake of Agri-insurance is another issue that holds them back from taking out



credit. While the products are theoretically available in Senegal, few of the financial institutions offer any insurance beyond coverage on the principal loan amounts in the case of death.

Finally, there is some case for improving financial literacy amongst these farmers, especially as it relates to growing onions as a business. Many were unable to provide clear answers around cost of production, marketing costs, the benefits of accessing working capital etc.

Agri-insurance is theoretically available to farmers. But most financial institutions don't offer much insurance beyond life insurance to cover loans.

## 5.7 Fertiliser

Imported fertilisers in theory should deliver consistent product to the farming community. However, there have been complaints around cheating that go back to the early 90s. To combat this issue a national fertiliser committee was created. But a lack of resources means that they rarely carry out checks on fertiliser quality. Chemical compositions thus sometimes differ from that on the bag.

The imported fertilisers generally have very standardised formulations that haven't been adapted to local growing conditions, nor to potato specifically. In addition, soil conditions are not tested and so farmers rely on generic advice around fertiliser application. This seems a fairly blunt approach for such an important crop.

International investors, who have the ability to optimise these formulations, face local market conditions that discourage investments in larger more targeted fertiliser development, marketing and sales. Firstly, they face competition from the firms who are allowed to distribute fertiliser in the government subsidy program. Secondly, the subsidy program sets unrealistic price expectations for fertiliser in general. Thirdly, farmers rely sometimes on fertilisers from poultry or peanut shells. There are some concerns that this might need better management to avoid the unintentional spread of diseases.

## 5.8 Industrial Producer Issues and Opportunities

By far the biggest threat to the industrial production of potatoes is a lack of sustainable farming practices. Fields are not rotated meaning that a potato field is planted with potatoes year after year. A short respite might be given over the summer months when the fields are left fallow. However, during this period high summer temperatures mean that the soil bakes, reducing the organic matter in the soil. Green manuring and rotation would be helpful in maintaining soil fertility while helping to manage disease pressure. Until now disease outbreaks have been few, speculatively because of the high summer temperatures. But issues from increasing nematodes and cysts are emerging and this will need to be managed to ensure the sustainability of industrial production in Senegal.

Irrigation from the lake requires that water be pumped to the farm. This makes the **cost of fuel linked to irrigation** a sizeable contributor to the cost of production. Not being able to rely on electricity also increases the costs of refrigerated storage. This is especially critical in seed potato storage from one season to the next.

**Skills** issues on these farms are another common issue. Staff might have relevant qualifications, but often they lack practical skills and experience to be productive. As a result, these farms must





provide significant on the job training before staff can become productive. Specialist skills are currently being sourced from India and South Africa rather than from the local universities and training colleges.

Finally, Senegindia seems to have a reputation issue. Local producers feel that this business specifically is responsible for unfair competition in the potato market. Also, in 2016 an issue arose around land rights related to an expansion of the Senegindia farm. These are all potential areas of concern, especially as this farm is such a major producer in the country.

Land rights are a specific issue in attracting more investment into the sector. Large industrial producers are able to able large tracts of land, sometimes thousands of hectares. As these large farms develop, they attract labour from far afield. Over time these new settlers have a need for land. These pressures intensify existing frictions where it comes to land. The land rights system in Senegal is known to be fuzzy and complex. And for women and youth, this often means that they are marginalized when it comes to accessing land. These tensions erupted in 2016 leading to a land grab near the Senegindia development. Naturally all industrial investors across the open field crops are aware of the potential for friction with local communities. This is a potential hurdle when it comes to attracting further investment in the chain.

It will become increasingly important that the case for industrial development is made clearer to indigenous communities & wherever possible that community development is built into the project. It would be particularly helpful if some thought is given to how agricultural industrial investors can play a bigger role in dissemination of production techniques and support or the agricultural services that many small-scale famers requires if they are to increase the scale of their commercial investments. At present industrial producers play a small role in professional associations in Senegal. But this poses a real risk in that they remain separate from the sector. This will need some attention for the sustainability of this type of investments.

### 5.9 Processing Issues and Opportunities

Processing of potatoes in Senegal is currently limited to small scale crisp production. There is some interest in some producers to expand in to potato crisp production for children. However, snacking in Senegal is relatively low, thereby limiting the market. Nevertheless, the high transport cost of crisps provide a natural barrier against imports. Transporting crisps is mostly transporting air, with only 6tons of crisps that can fit in a container versus 23 tons of frozen chips. Furthermore, automatic processing lines are available from 100kg per hour, and become economic to operate at about 250kg/ hour. It might however require clever marketing strategies such as focussing on the Hotel and airline sector.

Frozen chips however as well as industrial starch is a low margin high volume business that is impossible to develop in Senegal. The minimum scale is 5 tons per hour, and Belgium and the Netherlands have more than a dozen factories capable of processing more than 60 tons per hour.

Another potential innovation opportunity in processing would be to explore the production of fresh cut chips, potentially blanched/ pre-fried delivered daily to the HoReCa. This has been a growing sector in Nairobi. It can be started at a very small scale with manual production. The advantage for fast food, restaurants and hotels is that they save space as the production of chips requires a lot of staff and space. Furthermore, fresh cut chips have a much better flavour than frozen chips.



## 5.10 Marketing and Distribution

The Market Regulation Agency has been instrumental in organising with Senegindia to ensure that their potatoes reach the market towards the end of the small scaler marketing season. This has helped to manage pricing in the market, so that farmers face a normal level of variation in prices that you would see in just about every vegetable chain around the world. In some years the system isn't perfectly managed, and this creates some tensions between Senegindia and producers. This is especially true as Senegindia is often allowed to sell their potatoes around festivities, which might coincide with small scaler marketing seasons.

The overwhelming volume of potatoes are sold at markets. These reach retailers via a finely tuned system of traders, wholesalers and retailers. Packaging for potatoes has become more available in recent years. Yet many still re-use packaging, which in some cases are damaged and torn.

Finally, the potatoes must be transported from the Niayes to markets around the country. While significant progress has been made in improving the quality of road networks in the primary road network an along the coastal areas, there is still much more that needs to be done. This is especially true when it comes to accessing rural areas. These logistics issues likewise affect the costs of distribution of potatoes, especially as production is limited to a small region.

## 5.11 Dynamic Knowledge Development

As with many other agricultural value chains in Senegal, extension services are fairly limited. Also, development of new knowledge is weak. Little research and development is being proactively carried out on agricultural techniques, seed optimisation, sustainable farming etc. This is particularly concerning in view of the ecological sensitivity of the production environment that is exposed to climate change and salination. Potatoes are also particularly vulnerable to poor farming practices. Diseases can easily be introduced, or nematode infestation set in if there's poor crop rotation. This will require some attention to ensure sustainable expansion of the sector.

Producers could benefit from proactive knowledge development. How can farmers adjust to their farming practices to be less vulnerable? How can resources be best allocated to ensure sustainable agriculture? This requires proactive work to identify appropriate seed for the Senegalese context and then to ensure that farming techniques are optimised for this country. contexts.

In addition, more could be done to ensure that the sector is more responsive to weather and climate change. On the most basic level this means ensuring that farmers have better access to information. This includes weather forecasts and faster agricultural advice, to meet changing conditions. Some local programs, such as STARS, have been experimenting with digital tools to share up-to-date information around markets and weather. Yet, more needs to be done to develop knowledge around how to best plan for and respond to these changing market and environmental conditions.

## 6 Environmental Sustainability (Circular Economy)

Potato production is possible only in the Niayes and a few areas in the Senegal River Valley. The favourable growing conditions in winter mean that there's increasing competition for resources in this area, particularly for water. This is drawn from underground wells and boreholes. Sometimes these need to be drilled more than 100m below the surface. This poses a real threat to the



communities who rely on this groundwater for drinking water. This includes Dakar, which is draw water from this underground aquifer.

At a systemic level more attention needs to be paid to land management and to planning of areas that will be used for production. Some deep introspection is required around the development plan for the Niayes. What crops should be zoned for this region, if any at all? Which productive activities in the Niayes should be redirected to other parts of the country? Should potato production- especially of industrial producers- be regulated so that expansion is directed north towards the lake? Or should small scalers be encouraged to intensify production nearer the coast?

A second related issue is **declining soil health**. Continued Irrigation, heavy application of fertilizers and pesticides and leaving lands fallow in the hot summer months all affect the salinity of the soil, organic matter, micro-organisms and the groundwater. While this affects small scalers to a certain extent, traditional crop calendars and smaller scale of production means that they raise a smaller threat. On the other end of the spectrum growing industrial production requires that some efforts be made to ensuring that these producers grow while incorporating more sustainable farming practices that protect soil health.

## 7 Socio-Economic Development (food security, employment, women and youth)

### 7.1 Livelihoods

Potatoes offer a valuable opportunity to improve livelihoods. Potato production is a lot more profitable than onion production. The gross margin per kg in real terms is 5 times higher, while the yield per ha is comparable. This means that the profit per ha is 5 times as high: 2,5 million CFA for a potato farmer with 20 tons per ha versus 500,000 FCFA for an onion farmer. This is a huge difference for farmers who only have a limited amount of land available. Figure 54 provides an overview.

Figure 54 Comparison of Costs and Revenue for Potatoes Vs Onions in the Niayes

	Onions	Potatoes
Yields	15-25 tons per ha	15-25 tons per ha
Average Farm Gate Price per kg	125 FCFA per kg	250 FCFA per kg
Gross Margin	20%	50%
	25 FCFA per kg	125 per kg
*Based on existing cooperatives in the Niayes		
**Based on average market prices for onions; sales price for potatoes based on contract prices with Senegindia		

The profitability of potato farming seems almost too good to be true. However, it is consistent with what we have seen in other African countries such as Kenya, Cameroon and Nigeria. Potato farming is a high risk- high reward crop. It requires high investments in inputs, particularly seed, and labour. It is also a diseases prone precision crop, that can easily be wiped out by disease. In our experience the break-even point is usually around 5 tons per ha, which tends to be the average yield of small scale farmers, going up to 10 – 15 tons for emerging commercial farmers. Every ton of yield above this 5 tons makes the business a lot more profitable quickly.

From the perspective of employment, the effort required for land preparation and harvesting of potatoes means that far more labour is required overall. Figure 55 makes a comparison between onions and potatoes.

Figure 55 Comparison of labour utilisation for potato and onion production in the Niayes

Labour utilisation comparison- Onions vs Potatoes (Niayes), per ha; 2019		
	Onions	Potatoes
Land preparation	100 000 FCFA	200 000 FCFA
Ongoing care	3 sourghas x 4 months = 360 labour days	3 sourghas x 4 months= 360 labour days
Harvesting and sorting	80 labourers x 1 day= 80 labourer days ( 160 000 FCFA)	500 x 225= (112 500 FCFA)

Falling prices in the first half of the season and the tendency to push risk upstream towards farmers has already been mentioned as a key issue. A review of the drivers of quality issues in the potato chain also reveals that they produce these with relatively little technical, or financial support. Yet farmer's face a variety of additional pressures. Unreliable inputs, climate change, low development of agricultural or financing products and growing production from industrial highly competitive producers all raise risks to their livelihoods.

## 7.2 Food security

Food security- and developing some degree of self-sufficiency- is a particularly pressing theme in Senegal. Potatoes have the potential to contribute significantly to achieving these ambitions.

Firstly, few countries in West Africa are able to grow potatoes on any real scale. Only 4 countries in the ECOWAS region produce potatoes on any real commercial scale. But, Senegal, thanks to the unique conditions in the Niayes, absorbs 1/3 of all regional potato seed imports. This makes it a very important producer.

Yet there is space to grow. If the countries in this region follow global patterns, we can expect that demand for potatoes will increase. As a result, there's a unique opportunity for Senegal to position itself ahead of this curve. To satisfy a growing appetite for potatoes each available inch of land for potatoes in the Niayes and along lac du Guerrier will need to be utilised to its fullest potential. This will require some intervention to increase yields beyond the current levels.

Figure 56 Potato Seed Importing Countries in ECOWAS

	Imports Seed Potatoes by countries in ECOWAS (2019, tons)
Senegal	4200
Mali	3300
Nigeria	1500
Guinea	1000
Other	1500

Source: ITC trade Map

### 7.3 Inclusive Development

The potato value chain is at present a fairly masculine enterprise. Potato production requires access to land as well as financing for relatively expensive potato seed and irrigation. It's also a very physical endeavour, which is in many respects stereotypically male. Yet, the high revenue per ha suggest that this would be a particularly good area where women and youth could prosper. In other African countries there tend to be more female farmers involved in potato growing.

#### 7.3.1 Women and Intensive cultivation of precision crops

Experience in East Africa suggests that women have particularly good fit with potatoes. Profitable potato farming can be done on relatively small plots of land. This is relatively more accessible than that required for more extensive crops. A second advantage is that good agricultural practices and greater precision in farming- typical of female driven farming enterprises- deliver returns. Successful cultivation can create a virtuous cycle where high revenues enable greater investment in mechanisation, which increases precision, that increases revenues and so on.

#### 7.3.2 Women and Marketing

Women are highly involved in the marketing of vegetables, which includes potatoes. Expanding production and bring quality produce to market increases their ability to earn a good living, reduces waste from poor farming practices, sorting or handling.

#### 7.3.3 Industrial packhouses

Women tend to be over-represented in the more detail-oriented activities in packhouses. This bodes well for their ability to find employment. This is reflected in the employment statistics shared by industrial vegetable growers. At Grand Domaine du Senegal (GDS) 22% of their staff is female. Van Oers, employs more than 4000 women during the harvest period. Furthermore, this is an area where women are generally not in competition with men. Industrial production is this a meaningful way to create better inclusivity of women in the workforce.

#### 7.3.4 Youth & Practical Horticultural and Mechanisation services:

Technical development in the potato sector will require a skilled extension service system, with trainers who are skilled and are continuously updating their skills. This has a natural fit with the youth. This is especially true if technology is introduced to the extension services. For example, if digital tools are used to dispense advice, provide weather reports etc.

Mechanization and irrigation services are likewise services that are better suited to a more youthful investor and workers. These are new areas, that provide space for the youth to establish themselves without having to displace established actors. The technical nature of these services also asks for continued education and skills development.

Enabling women and youth to make use of these opportunities requires a number of stumbling blocks to be removed. Firstly, without knowledge and skills it's unlikely that they'll have the wherewithal to take on these opportunities. Secondly, social norms generally dictate that any savings or surpluses are used to finance activities of the men in the household, rather than those of women and youth. Developing a business requires finance. Even more so when this business relies of mechanization or irrigation equipment. Ensuring that they are aware of these opportunities and developing financial products specifically for these groups is a first step to getting them involved in this chain. Another would be ensuring that they are armed with financial literacy. Finally, by organizing them in small producer groups they are better able to access



financing, technical training and can be emboldened to take on these new challenges. (IFAD, 2018).

## 8 Options for Interventions

### 8.1 SWOT Analysis

The following SWOT analysis resumes the foregoing issues:

<p>Strengths:</p> <ul style="list-style-type: none"> <li>– Market protections (import freezes for most of the year, quotas and tariffs)</li> <li>– Increasing area under cultivation and yields</li> <li>– Good profitability of potatoes (50% for small scalers)</li> <li>– Investment from Industrial producers (Mbane area)</li> <li>– Industrial producer loaning out mechanisation equipment to emerging farmers</li> <li>– Privatised seed and input markets</li> <li>– Relatively high yields</li> </ul>	<p>Weaknesses:</p> <ul style="list-style-type: none"> <li>– Unreliable seed quality (poor regulatory control, weak patent right protection, poor coordination with suppliers, disease pressure)</li> <li>– Distortionary effect of fertiliser subsidies on input marketing and sales</li> <li>– Reliance on migrant labour at harvest &amp; labour for manual irrigation</li> <li>– Risk carried by farmers</li> <li>– Great improvement required in extension services provision from the state and private sector</li> <li>– Lack of agri-insurance products</li> </ul>
<p>Opportunities:</p> <ul style="list-style-type: none"> <li>– Mid-tier; mid quality potatoes for local markets</li> <li>– Regional export opportunity in the peak production season, especially to the Ivory Coast</li> <li>– Space for women as employees in industrial farms (packhouses), agri-service development (mechanization, irrigation, storage)and retailing of quality, storable potatoes</li> <li>– Introduce mechanisation to reduce waste &amp; improve productivity</li> </ul>	<p>Threats:</p> <p>Unsustainable agricultural practices- water management, land management, soil fertility</p> <ul style="list-style-type: none"> <li>– Risks from climate change, increased salination</li> <li>– Pressure on groundwater suppliers that feed Dakar</li> <li>– Fuzzy land rights environment</li> <li>– Reputation risks from industrial producers who are seen as being separate and unfairly competing with local producers</li> </ul>

### 8.2 Interventions (SDG Goals and Impact, Dutch Transfer)

The potato value chain is ripe with opportunity. Making the most of the substantial potential of the chain for expansion does however require an acknowledgment of the constraints on production- a young market that's still developing, current limitation on yields and a need to

ensure that more sustainable practices are hardcode in to the expansion of the sector. As a result, it's envisioned that interventions in this chain follow 4 major directions:

1. Increasing productive potential
2. Accessing regional markets
3. Hardcoding of sustainable farming practices
4. Inclusion

Potato farmers in Senegal are achieving remarkable yields when compared to many African countries. However, there's still potential to grow. To do so, a number of issues will need to be tackled. Firstly, farmers will need to get a more reliable access to quality, disease free seed. This will require interventions in the regulatory environment as well as with seed systems design. Some work will need to be done to develop and implement as workable made to measure legislative framework that governs vegetative multiplication of tubers. This can be supported by expanding participation of quality seed providers from key EU markets. The Netherlands is a world leader in potato seed production, so it would seem sensible to match Dutch producers of seed potato with local growers of ware. This might be extended by supporting efforts to develop local potato seed multiplication. This is a technical process that requires careful attention to managing disease and seed quality. As such partnerships with Dutch knowledge institutes and commercial seed providers would seem sensible. India is another potential partner as they develop seed specifically adapted to tropical climates and higher temperatures. This would also allow for a more dynamic seed system, where technology and techniques can be transferred and continuously adapted to the local context.

The productive potential of Senegal can also be expanded by firstly encouraging further investment from industrial producers. A second possibility is to develop outgrower schemes with a lead farmer model. This would focus small scale and emerging farmers in the Niayes on potato production. Clustering farmers in this region could help to facilitate mechanisation, which is another important activity within this intervention area. Mechanisation would allow for improved land preparation, lower waste at harvest and mechanised irrigation.

This model would be helpful in facilitating accessing regional markets- especially to the Ivory Coast which is an importer of potatoes from Europe. Some work might be needed to encourage investors to explore this idea further.

To ensure that the potato production system as whole remains sustainable there seems to be a need for ongoing **knowledge development**. Learning new techniques so that salinisation can be better managed if not reduced, that water resources are used sparingly, soil fertility is protected or improved will all be important ingredients for sustainable production. At the industrial level incorporating crop rotation is critical so ensure the long-term sustainability of potato production. The cost of getting it wrong is just too high. To build in improved sustainability, the regulatory environment around land and water management will need to be improved. Clearer guidance and potentially legislation over crop rotation, irrigation, water use and land planning, pesticide use etc are all needed to ensure that a vulnerable to salinisation and climate change is protected, while supporting the expansion of potato production.

Finally, there are opportunities to encourage more **inclusive growth** in this chain. This would be my ensuring that the barriers to women and youth participating more fully be removed. In addition, more work will need to be done to skill them for the various opportunities that **are**



**presented in a developing potato chain.** Mechanization and irrigation service provision as well as agricultural extension services are all new areas where they can carve out a space for themselves. This will however require a focus on access to finance, services, skills development both of farmers and professional agri-skills.

### 8.3 Overview of proposed interventions

Bottlenecks And Interventions For The Input System				
Bottlenecks	#	Interventions	Fit with Dutch Knowledge, Strategic interests etc.	SDG Goals
Productivity- the Seed System: Unreliable seed quality, late arrivals and introduction of diseases.	1a	Strengthen Seed Systems Support especially capacity building for regulatory control.	****	1, 2,
	1b	Support the expansion of the private sector supply of quality potato seed (seed, fertilizer and pesticides). Ensure that technical product training for distributors is a key part of the product offer.	***	1,2,4
	1c	Explore the technical feasibility of private sector seed multiplication. Integrate required regulatory controls.	***	1,2
Productivity- enhanced farming practices Opportunities to increase farming techniques of farmers to ensure that maximum yields are delivered sustainably.	2a	Improve extension services to improve skills of farmers (farming and financial literacy). This should include contributing to curriculum development of professional training centres (agronomic skills, machine repair etc.).	**	1,2,4
	2b	Support the expansion of mechanization , irrigation services & commercial storage	*	1,2
Regional Expansion Opportunity to produce quality premium potatoes for regional markets.	3	Support the development of commercial outgrower models linked to improved quality production (incl. storage, packaging, GAP, quality inputs).	***	
Sustainability Unsustainable agricultural practices favouring salination, over-use of water, intensive cultivation in the Nlayes etc.	4	Strengthen research and development into sustainable farming techniques, water and land management, soil fertility etc.	****	1,2,12
Inclusion: There are opportunities for women and youth to participate the value chain as employees, producers	5	Support women and youth in participating mechanization and irrigation services, extension services etc. This requires a focus on access to finance and skills development.	**	1,2,5,4



and service providers especially of mechanisation services enter the value chain as growers and mechanisation service providers.

Sustainable Development Goals



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## Value Chain 4 - Vegetables



## 1 Executive Summary

Since the early 2000s, The EU vegetable market has undergone a significant evolution. Thanks to international sourcing, traditional summer vegetables are now available year around. To accommodate food safety and to reduce supply chain risks, retailers prefer to source vegetables from a few, vertically integrated suppliers, who can provide reliable supplies of vegetables year-round.

Morocco, Egypt, Kenya and Senegal have developed into sourcing locations for these firms. To attract foreign investment and stimulate the cultivation of export-oriented crops, the Senegalese government has introduced incentives such as VAT and import duty exemptions. Dutch, British and local investors have responded, enabling Senegal to become a meaningful exporter of green beans and sweet corn, along with cherry tomatoes, butternut, radish and spring onion.

Despite growth in production there still seems to be unmet demand in the market between December and April, when imports and consumption of vegetables are still far below the peak. And Senegal has a good opportunity to ride this wave of development, provided that they are able to successfully attract investors. Yet, industrial integrated production has come with consequences- both positive and negative- for Senegal. It provides much needed employment- especially of women and youth. It also contributes significantly to trade balances and revenues. Through the corporate social responsibility initiatives of these firms, there have been significant improvement made to the infrastructure, clinics, schools in these communities.

But there are also costs. Firstly, small farmers in local outgrower schemes have not been able to keep pace with food safety requirements in the EU, nor have they remained competitive. They have largely exited the export market, with only 2 smaller outgrower schemes currently exporting to the EU. And these two remaining schemes face intense pressure from industrial producers who are lobbying to have outgrower schemes banned from being able to export. This they hope will avoid produce with less tightly controlled pesticide residues from reaching the EU and ruining the market for all Senegalese producers.

Secondly, industrial intensive production methods require intensive irrigation & pest control. This has an impact on soil health. The demand for water in the Dakar, Niayes and even along the Senegal River Valley require judicious use of the existing water resources, with far greater control on where production is planned, what this means for water supply and finally how to control salinisation that is increasingly problematic. This has both implications for the types of research and development needed in Senegal, for the dissemination of this knowledge and finally for the regulatory development and implementation.

Expanding investment in the production of vegetables for the EU winter season seems to make commercial sense and can deliver some development impact. Yet to make the most of this opportunity the investment promotion authorities APIX and ASEPEX (exports) would need to be strengthened. Some key areas highlighted by investors are clarification of land rights & efficient delivery of incentives. Poor administration mean that these are often not practically obtainable for investors. Finally, knowing the pressure on land and water resources it would be sensible to support APIX and ASEPEX to become better at investment promotion. This would include improving their ability to develop project concepts that include land and water management; troubleshooting and support of existing investments to expand.

## Résumé Légumes

Le marché européen des légumes a connu une évolution importante depuis le début des années 2000. Grâce à l'approvisionnement international, les légumes d'été traditionnels sont désormais disponibles toute l'année. Pour assurer la sécurité alimentaire et réduire les risques liés à la chaîne d'approvisionnement, les détaillants préfèrent s'approvisionner en légumes auprès de quelques fournisseurs verticalement intégrés, qui peuvent fournir des approvisionnements fiables en légumes tout au long de l'année.

Le Maroc, l'Égypte, le Kenya et le Sénégal sont devenus des sources d'approvisionnement pour ces entreprises. Pour attirer les investissements étrangers et stimuler la culture de produits destinés à l'exportation, le gouvernement sénégalais a mis en place des mesures d'incitation telles que l'exonération de la TVA et des droits d'importation. Les investisseurs néerlandais, britanniques et locaux ont répondu à l'appel, permettant au Sénégal de devenir un exportateur important de haricots verts et de maïs doux, ainsi que de tomates cerises, de courges butternut, de radis et d'oignons de printemps.

Malgré la croissance de la production, il semble que la demande demeure supérieure à l'offre sur le marché entre décembre et avril, lorsque les importations et la consommation de légumes sont encore bien inférieures au pic. Le Sénégal a la possibilité de surfer sur cette vague de développement, à condition de réussir à attirer les investisseurs.

Pourtant, la production industrielle intégrée a eu des conséquences pour le Sénégal, aussi bien positives que négatives. Elle crée des emplois très nécessaires, en particulier pour les femmes et les jeunes. Elle contribue également de manière significative à la balance commerciale et aux recettes. Grâce aux initiatives en termes de responsabilité sociale de ces entreprises de taille industrielle, des améliorations significatives ont été apportées aux infrastructures, aux cliniques et aux écoles de ces communautés.

Mais la production industrielle entraîne aussi des coûts. Premièrement, les petits agriculteurs participant à des programmes locaux d'aide aux petits exploitants n'ont pas été en mesure de suivre le rythme des exigences de l'UE en matière de sécurité alimentaire, ni de rester compétitifs. Ils se sont largement retirés du marché de l'exportation, et il ne reste que deux programmes d'aide aux petits exploitants exportant actuellement vers l'UE. Et ces deux programmes d'aide aux petits exploitants restants sont soumis à une forte pression de la part des producteurs industriels qui font pression pour qu'il soit interdit à ces petits exploitants d'exporter. Les producteurs industriels espèrent ainsi éviter que des produits contenant des résidus de pesticides moins strictement contrôlés n'atteignent l'UE et ne ruinent le marché pour tous les producteurs sénégalais.

Deuxièmement, les méthodes de production industrielle intensive nécessitent un contrôle de l'irrigation intensive et une lutte contre les parasites. Cela a un impact sur la santé des sols. La demande d'eau dans la région de Dakar, des Niayes et même le long de la vallée du fleuve Sénégal nécessite une utilisation judicieuse des ressources en eau existantes, avec un contrôle beaucoup plus important sur le lieu de production prévu, sur ce que cela signifie pour l'approvisionnement en eau et enfin sur la manière de contrôler la salinisation qui est de plus en plus problématique. Cela a des implications à la fois sur les types de recherche et de changement nécessaires au



Sénégal, sur la diffusion de ces connaissances et enfin sur l'élaboration et la mise en œuvre de la réglementation.

L'augmentation des investissements dans la production de légumes pour la saison d'hiver de l'UE semble être commercialement justifiée et peut avoir un certain impact sur le développement. Cependant, pour tirer le meilleur parti de cette possibilité, il faudrait renforcer les autorités de promotion des investissements APIX et ASEPEX (exportations). Les investisseurs insistent notamment sur des éléments clés tels que la clarification des droits fonciers et la mise en place efficace d'incitations. En raison d'une mauvaise gestion, il arrive souvent que les investisseurs ne puissent pas les obtenir dans la pratique. Enfin, compte tenu de la pression exercée sur les ressources en terre et en eau, il serait judicieux de soutenir l'APIX et l'ASEPEX afin de mieux promouvoir les investissements. Il s'agirait notamment d'améliorer leur capacité à développer des concepts de projets incluant la gestion des terres et de l'eau, la résolution de problèmes et le soutien des investissements existants pour l'expansion.



## 2 Background and Method

The aim of this study is to provide insights into the Senegalese vegetable value chain and to define critical interventions that are needed for the sector to flourish. Ultimately it is hoped that these interventions will play a useful part in fueling an improvement in the livelihoods and food security of the Senegalese people, while improving the lot of women and youth and the environment.

More specifically the study aims to (i) describe the market, production and enabling environment in the onion chain in Senegal (ii) reveal the key issues, opportunities and bottlenecks in the value chain (iii) propose specific interventions that can help to address these bottlenecks & allow for the value chain to have greater impact (iv) identify areas where inclusive participation of women and youth in the economy can be stimulated (v) highlight opportunities for improved circular economy practices (vi) recommend areas where public, private and the knowledge sectors can make valuable, if not unique, contribution to these interventions.

The study involved 3 distinct phases. Firstly, desk research was conducted to understand the existing knowledge and open questions when it comes to the onion value chain. This was supported by interviews with subject matters experts. Generally, these were people, businesses or institutions who provide supporting services, knowledge development or institutional support in the agricultural sector in Senegal. To get a better understanding of Dutch expertise and strategic and commercial interests, interviews were conducted with businesses who trade with Senegal, professional sector organisations, research institutes or service providers who offer knowledge services in aid of Senegalese agricultural development etc. These were complimented with interviews of various sector experts involved in business development and access to finance support for East African export vegetable producers.

In step 2 we carried out field research in the Senegal River Valley area as well as in the Niayes. This included visits to farmer groups, marketing platforms, financial institutions, the Senegal River Valley Development Authority (SAED) and industrial growers.

Finally, in step 3, field research was conducted with 75 consumers, 15 trader and representatives in 3 cities/town in Senegal viz Dakar, Thiès and Pikine. 5 representatives from the Hotel restaurant and catering field (HoReCa) were interviewed in Dakar.

We must highlight that this research was carried out during the COVID 19 period, but after local constraints on travel were lifted. This has both advantages and disadvantages. A large number of interviews could be conducted telephonically, which made including a variety of perspectives and experiences from Senegal and the Netherlands far more possible. In some instances, the new “work from home” norm made interviewees more available. A downside was that research was carried out later than planned- outside of the key production period for onions. Nevertheless, access to farms, financial institutions and marketing platforms was possible during the fieldwork. These greatly enriched the quality of insight reflected in this report.

## 3 The Market for Green Beans

### 3.1 The European Market for Vegetables

Production of summer vegetables for the European winter has been a long-established activity in Senegal. The very first attempts were made in the 1970s when Bud Holland began to produce green beans for export to the Netherlands. Since then, European shoppers expect that fruit and





vegetables, previously only available in season, are now available all year round. Global sourcing has expanded to cater to this need.

Shoppers are however not only looking for a continuous supply of produce. They're also increasingly concerned with quality and food safety. In response, retailers have been at the forefront of various food safety standards. Producers around the world are generally required to meet minimum pesticide residue standards and phytosanitary controls. In many cases certified product is seen as a minimum criterion required to trade with EU importers. HACCP, BRAC and a host of other certifications provide some measure of control that signal to retailers that the products are safe.

To avoid reputational risk, retailers have focussed on tightening control over their supply chain. Increasingly they are working with fewer suppliers, who are tasked with sourcing product all year around. In turn these suppliers have invested not only in strengthening relationships with producers in developing markets, but in themselves producing abroad. Often, they produce in a variety of locations around the world, making sure that as one country comes to the end of the season, they're able to source produce from another.

The food services sector (restaurants, hotels and catering) is another key outlet for produce in addition to consumers. Typically, wholesalers purchase produce from around the world. They then supply this to the food services sector and especially the hotel, restaurant and catering trade. The diffuse nature of this sector means that there's lower reputational risk. As a result, they have less of an incentive to control the supply chain. These wholesalers tend to source produce from more suppliers. They're also more fluid in their choices than retailers. From season to season they're able to switch suppliers. Nevertheless, food safety is important. So long term relationships are also valued.

### 3.2 The Market for Green Beans

Green beans are an important vegetable in most of the EU, and one of the most popular across most of the EU. Traditionally green beans are a summer vegetable, though the season has been increased through growing of different varieties in different countries across the EU.

Yet, green beans have one major difference from many other vegetables such as peppers, tomatoes, courgettes: they have remained an open field crop. Where many other vegetables can be produced year-round in green houses, this is not the case for green beans. The yield per area is simply too low to make growing in green houses economically feasible. In addition, picking of green beans is very labour intensive and thus expensive in Europe. As a result, green house farmers have much more lucrative alternatives, and the EU remains in winter dependent on import from areas where green beans can be grown in open fields.

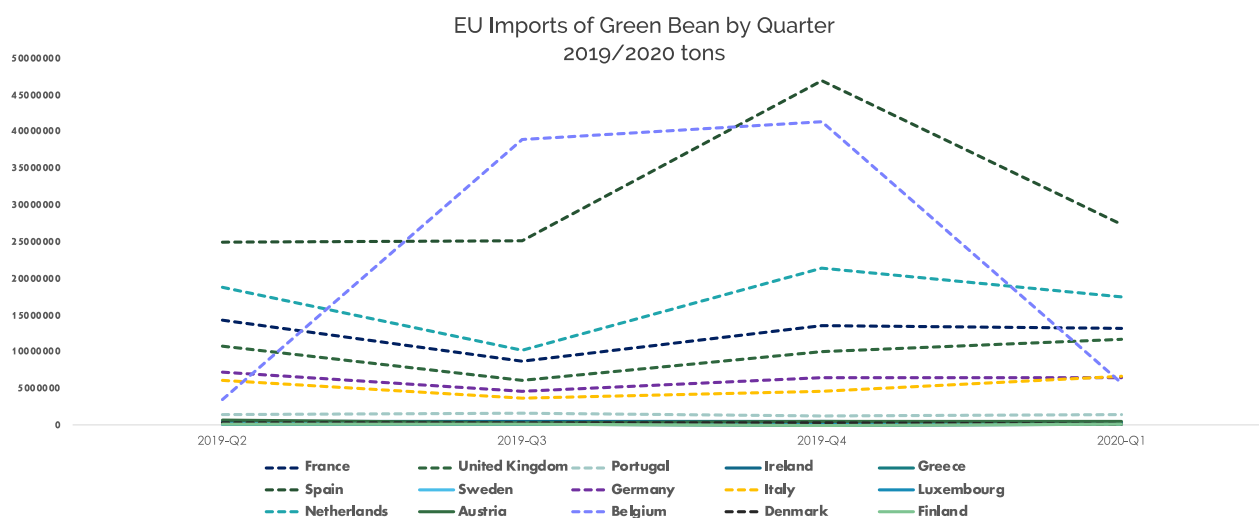
To a limited extent fresh green beans from Senegal and other African producers also compete with frozen beans. However, in terms of flavour and structure they are not comparable at all. Frozen green beans are mostly consumed as broken beans mixed with carrots and other vegetables.

The demand for green beans in the EU winter can thus only be met by fresh imports. Spain is the largest importer of green beans in the world. 20% of the world's green beans are sourced by Spain, who import the some of the largest volumes of green beans throughout the year.



By autumn Belgium begins to ramp up imports of green beans. This is both for the fresh market and frozen vegetable production. By the peak winter months all of Europe begins to import green beans.

Figure 57: EU Imports of Green Beans Per Country



EU imports of green bean in the winter month are sourced from Morocco, Egypt, Kenya and Senegal<sup>10</sup>.

Morocco is the world's largest supplier of export green beans. Over a quarter of global exports originate from this country. As a result, they supply to most of the EU market. However, the bulk of their green beans (63%) are exported to Spain, who sources almost exclusively from Morocco. Morocco is also an important sourcing destination for France and the Netherlands, who each import 16% of Morocco's green bean exports. Collectively Spain, Germany and The Netherlands account for more than 90% of Moroccan green bean exports annually.

To complete supply from Morocco the Netherlands has developed secondary sourcing in Egypt, Senegal and Kenya. France relies largely on Kenya as a secondary sourcing origin. Belgium and the United Kingdom both use Kenya as a primary sourcing location. This produce is mostly air-freighted, but some sea freight is also used.

But secondary sourcing locations differ. Belgium sources this from Egypt, while the United Kingdom sources from Morocco and Egypt. Both of these locations allow for sea and air freight, and road freight from Morocco to Belgium.

<sup>10</sup> Egyptian exports are excluded from these figures as they are unreliable

Figure 58 Export volumes from African Green Bean Producers to Key EU Importers

Export volumes from Key African Producers to Key EU importers				
	Morocco	Egypt	Kenya	Senegal
Spain	86 000			
Belgium		4 800	9 400	1 400
Netherlands	22 200	7 800	4 200	7 500
France	22 200	792	5 000	454
United Kingdom	4 000	4 000	15 000	1 340
*Source: ITC Trade Map				

Volumes being exported from Kenya have fallen since the start of the decade. Today, Kenya exports only a third of the green beans they exported in 2012, with much of these declines coming from the UK. Exports from Morocco and Senegal have grown over this period, with Morocco adding more than 10 000 tons of green bean exports, largely in the winter period.

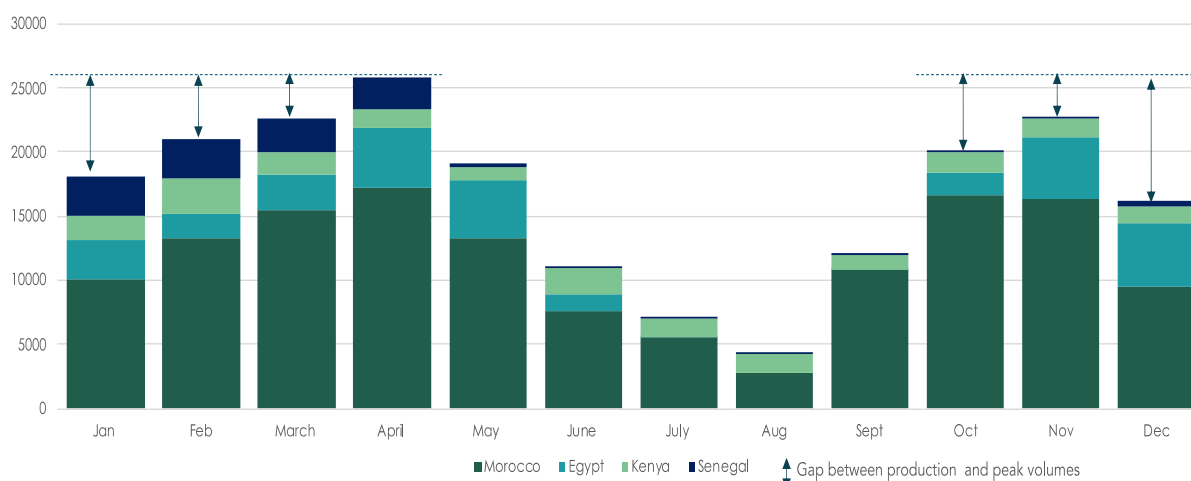
Figure 59 Changes in Export Volumes from Key African Exporters to the EU

Change in Volume and Value of Exports (2015-2019)				
	Morocco	Egypt	Kenya	Senegal
	+10 000 tons	-10 000 tons	-3 000 tons	+1 000 tons
Volume Growth	+3%	-2%	-3%	+4%
Value Growth	+20%	-14%	-3%	+8%
*Source: ITC Trade Map				

During winter month, imports from Morocco, Kenya, Egypt and Senegal into the EU peak at just under 26 000 tons. However, for much of the winter they sit far below this maximum. This gap in production suggests that there is space to export increased volumes between October and March. It would seem that from May to September export volumes are limited because of competition from production in the EU. Figure 60 shows the gap between maximum exports and consumption in April and actual exports for the month when the EU does not produce green beans.

Figure 60 Monthly Green Bean Exports from Key African Countries<sup>11</sup>

<sup>11</sup> Volumes exported from Egypt have been calculated using EU country import figures. Monthly export figures were not available for the Maghreb and East Africa. These monthly export figures were computed based on the monthly contributions going to the EU.

Exports per Month from Key Africa Producing Countries  
2019, tons

### 3.3 Types of Beans

Though we talk about green beans in general terms, there are actually two types of beans consumed in the EU: fine beans and bobby beans. Southern Europe prefers fine beans which are no wider than 9mm. Northern European buyers tend to prefer a larger bean that's also wider (>9 in width). This is the bobby bean. Producers thus have to choose which market they focus on.

The size of the bean is not so much determined by variety but the time on the stem. Fine green beans are harvested every two days whereas bobby beans are harvested every 4 days.

### 3.4 Local Market

A combination of low consumption and low production have made for a relatively small market for vegetables, with a narrow variety in the market. Tomatoes, potatoes, onions, okra and aubergine are consumed more often. However, green beans and sweet corn are eaten relatively infrequently. In other markets where European vegetables are grown for exports, rejects are often sold on the local market at affordable prices. This stimulates demand of these vegetables. For example, Kenyans now eat green beans fairly often and see it as a part of their regular menu of vegetables. Yet 10 years ago this wasn't the case.

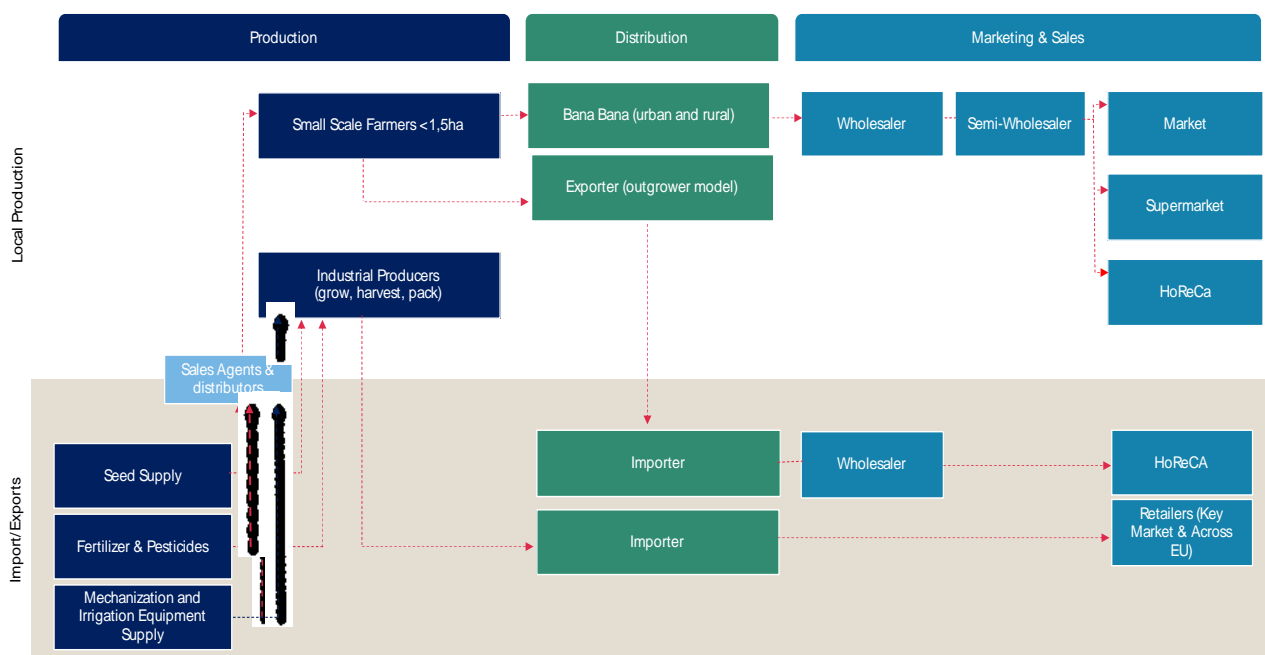
However, in Senegal producers who want to benefit from VAT exemption and other financial incentives for exporters are limited to being able to sell only 20% of their produce locally. As a result, consumption of green beans and other export oriented vegetables is growing slow and the market is quite small.

## 4 The Structure of the Value Chain

### 4.1 Overview of the Value Chain

The value chain is relatively simple, with the bulk of volume moving from large industrial producers to importers in the EU who sell to retailers, or wholesalers for the HoReCa market. Only 2 outgrower schemes exist where small producers export to the EU. Small scale farmers supply the national market via a long chain of traders (bana bana), wholesalers and semi-wholesalers.

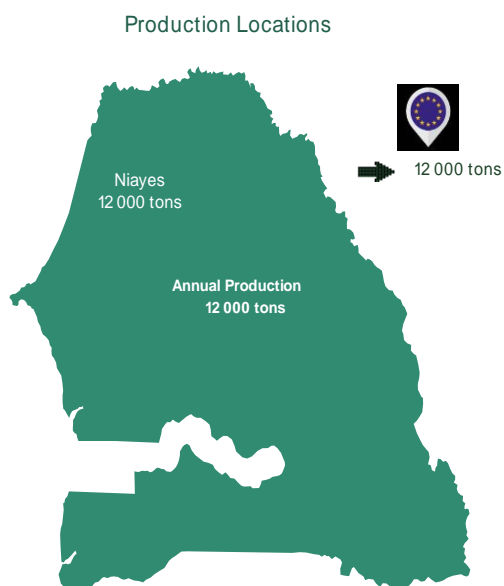
Figure 61: Overview of the Green Bean Value Chain



## 4.2 Production Locations, Calendar and yields

Green beans and sweet corn are largely produced in the Niayes and along the Senegal River near Saint Louis.

Figure 62: Map of the Growing Region For Export Vegetables



Between July and October humidity and high temperatures prevent producers from sowing seed. Disease pressure is markedly higher than during the dry season. So, some producers in Senegal close their operations. Then, in October, as the humidity and temperature falls farmers begin to prepare for the winter dry season production. A variety of vegetables are planted at this time. These range from onions and potatoes, to European vegetables such as green beans, sweet corn, cherry tomatoes, radish, spring onion. Some local vegetables such as Okra, peanuts, manioc etc are also grown in this season.

Rainfall in Senegal is low, but especially at this time of the year along the Senegal River Valley. As a result, these vegetables are grown under irrigation.

Senegal produces both the fine bean for Southern Europe and the bobby beans for northern Europe, which are basically the same variety but harvested at different intervals. Fine beans are harvested every two days whereas bobby beans are harvested every 4 days and thus have time to grow larger.



Figure 63 Overview of growing season in Senegal

Variety	Cold Season Crops			Hot Season Crops		
	Early Crops (hasty)	Full Season Crops	Medium-Late Season Crops	Late Crops		
Sowing/Growing Dates						
	October	November-December	January-February	March-April	May-June	July-October
Green beans	*	*	*	*		
Sweet Corn		*	*	*	*	
Outgrower local vegetables	*	*	*	*		
Operations closed for some industrial producers						*

### 4.3 Producer Typologies

#### 4.3.1 Large Industrial Producer

Six large industrial producers of green beans and sweet corn have sizeable investments in Senegal. These fall under an export promotion scheme which allows investors exemptions on VAT and customs duties on the import of equipment for 10 years. In return these companies are prohibited from competing with local market gardeners and are limited to selling no more than 20% of their produce locally.

All six producers produce primarily for retailers in the EU. There's a strong connection of producers to specific markets. SAFINA and Van Oers have their primary clients in the Netherlands while Barfoots and SCL focus first and foremost on the UK. GDS focuses on France while Misname focuses on Italy. The ambition is for these companies to produce a variety of vegetables for the winter months. Some opportunities that are technically possible are butternut, squash, onions, peppers, tomatoes. Yet, the reality is somewhat different. The focus of these companies until now has been on combined exporting of green beans, sweet corn and mangoes.

One of the core capabilities of these four companies is quality, yield control and continuous supply. They're required to produce high quality vegetables that meet retailer specification as well as the stringent EU food safety controls. As a result, these operations tend to be entirely integrated. Production, packing, marketing and logistics are all carried out by these companies themselves, with very little need to source inputs or services from the local market.

A second important skillset is their focus on delivering a continuous stream of produce throughout the season. To achieve this, they plant seed in weekly intervals from October through to March. This allows for ongoing harvesting and weekly deliveries to the EU.

The products can be shipped via sea freight. However, road freight has opened up for exporters. The produce can travel via Morocco to Spain and then onwards to the Netherlands. Within 9 days exporters are able to have produce in Dutch supermarkets. Because trucks are able to leave daily with smaller loads, receipts on the EU end are possible every day. This is in strong contrast with sea freight which requires consolidation of volumes and allows for weekly departures. Freight to the UK is generally via ship which takes 6 days.

These farms have their own privately-owned pack-houses and cooling facilities. These allow them to prepare and package produce for the EU. This involves top and tailing the beans and packing them in to shelf ready consumer packaging of 250 g and upwards depending on the needs of the retailer.

Farms in the Senegal River Valley source water for irrigation from the river, while those closer to Dakar use water from boreholes that sometimes go 100 m below the surface. Because these farms cannot sell vegetables or other crops for human consumption on the local market, they tend not to produce anything during the hot and rainy season. This tends to lead to a reduction of soil fertility, particularly a loss of organic matter and micro-organisms as the barren soil bakes in the sun. It also leads to soil salination, when salty ground water gets drawn up in a capillary reaction.

To solve this problem, SAFINA has experimented with production of rainfed Sorghum and irrigated maize for the production of silage for dairy farmers. However, in the Niayes where they are the irrigation cost are too high for profitable silage production. Furthermore off-takers are not always reliable, and the effort for a small profit is very high.

SCL has tried to produce silage from reject green beans and sweet corn, but the technique was poor, and this resulted in bad quality silage that was impossible to sell. Because they are located in the Senegal River Valley, irrigation is cheaper and maize silage production could be possible.

Both Safina and GDS have diversified into Mango production which has a complementary export season.

Figure 8 provides an overview of the large producers of vegetables.

Figure 64 Overview of Large Commercial Producers of Export Vegetables

	Barfoots SCL	Safina	GDS (Compagnie Fruitière)	Van Oers	Miname	West Africa Farms
Key Market	UK	Netherlands (AH)	France (EU redistribution)	Netherlands/ France, European Redistribution	Italy	UK
Export Crops	Sweetcorn, green beans, butternut squash, courgette, sweet potato, chillies	Green beans, mangoes, sweetcorn	Cherry tomatoes; Sweetcorn, mango,	Green Beans, Spring onion, Sweet Corn	Green Beans	spring onion, radish
Sweet Corn	18 000 tons		3000 tons			
Green Beans	2250 tons			6800 tons	1300 tons	

Tomato			10 000 tons			
Local Market crops				Onions, Cabbage, Carrot	Tomato, Carrots, Okra	
Land Area	2500 ha, 8ha covered	3000ha	255ha	600ha	500 ha	300 ha
Transport	Sea	Sea, Road	Sea	Air- 5% Sea- 80% Road: 15%	Road	Sea
Location	Saint Louis	Thiès	Diama, North of Saint Louis	Dakar (airport area)	Thiès and other	Saint Louis

#### 4.3.2 Small Scale Producers

Historically outgrower schemes enabled a host of small-scale vegetable producers to produce for the EU. However, the stringent food safety controls alongside the availability and general use of disallowed pesticides in Senegal have made this type of production risky and very small in scale for export. Nevertheless, small scale export production models do exist in Senegal. In this model two exporters act as consolidators of the volumes from small scale producers. They then pack this produce ready for the EU. Since the early 2000s this method of production has decreased in importance. Stricter controls in Europe and the strategic ambitions from importers has meant that investments have tended to veer away from outgrower schemes.

The small scalars produce on small parcels of land, generally less than 1 ha in size. Some larger producers and cooperatives do exist (>5ha), but are an exception. Most farmers have a variety of crops, thanks to increased uses of irrigation. In general vegetables are only one of the crops that are produced throughout the year. A small-scale farmer might produce an onion, vegetable and or potato crop throughout the dry season i.e., winter. Then in summer they could switch production to rice.

In general, the few small-scale producers cultivating these vegetables tend to focus on the much smaller local market. In some cases, this is facilitated by industrial producers who assist small scale vegetable producers in a quasi-outgrower scheme. Usually, the farmers focus on vegetables for the local market. These are peanuts, onions, cabbage, tomatoes, okra, niebe etc.

#### 4.4 Input Supply

The integrated producers source seed from international private sector companies. Quality seed is supplied by companies such as Bejo Seeds, who have a strong working relationship with these firms. For the more vertically integrated producers who produce in multiple countries, inputs in general are sourced for the entire group, rather than for their Senegal locations alone.

Government seed subsidies don't extend to green bean, sweetcorn or other classic vegetable crops, so they don't distort the seed market dramatically. However, subsidies on fertilisers affect the perceived value of fertilisers on the unsubsidised market. Subsidies of 50% are on offer for grains such as maize and rice. There is some leakage from this system. Corruption and maladministration mean that sometimes small commercial farms get access to the inputs that are





intended to benefit small scale subsistence and staple crop production. Also, the overlap between farmers of rice, maize and vegetables is large, and often subsidised grain fertilisers are used in vegetable production. As a result of the subsidy, they expect that fertiliser should cost less.

Pesticides- both certified for use in the Eu and not are all available in Senegal. In fact, some would argue, too available and affordable. Over usage of uncertified pesticides is one of the main reasons importers hesitate to source from small scalers.

#### 4.4.1 Local Seed Multiplication

Local multiplication of vegetable seed is only done on a very small scale by cooperatives in the sector. This isn't a major part of commercial production. Even small-scale producers typically access green bean and sweet corn (and other vegetable crops such as tomatoes, aubergine, squash etc) seed via input suppliers.

This sector is monitored more for the tax reasons and the impact on the local producers, than for proactive regulation of the sector.

### 4.5 Route to Market

Generally, the vertically integrated firms manage their own logistics and marketing. They tend to have a primary market and then produce is redistributed using the networks developed by their parent company or key clients. For example, Barfoots SCL has a UK partnership that directs most of their produce to the UK market. In the case of GDS, the French parent company co-ordinates imports via Marseille. Van Oers tends to manage redistribution of vegetables via the Netherlands. The primary markets serviced by Dutch suppliers tends to be Northern Europe and especially Germany.

French and Spanish importers tend to focus on Southern European markets. This might be a consequence of the different preferences for bean dimensions. Southern Europe tends to prefer extra fine beans.

#### 4.5.1 Wholesalers

While Senegalese producers tend to produce for major retailers, it's important to recognise that there is a different route to market for the Hotel, restaurant and catering chain. Typically, importers will source produce, which they then sell to wholesalers. Wholesalers will then supply to the HoReCa channel.

#### 4.5.2 Local Market Traders (Bana Bana's) & Coxeurs

Local vegetable production- outside of tomatoes, onions, sweet potatoes and aubergines potatoes- are relatively niche in Senegal. As a result, traders and coxeurs play a much smaller role than in other value chains.

Where they do operate, they purchase vegetables from the small producers and then transport these to wholesalers in markets where the vegetables will be sold. But as local bean and sweet corn consumption is still low in Senegal and rejects from the export chain cannot be sold on the market for food, their role in the total value chain is limited.

#### 4.5.3 Wholesalers- local



In larger markets, traders may sell the vegetables to wholesalers, but for beans and sweet corn this is not frequent.

## 4.6 Indirect Actors in the Onion Supply Chain

### 4.6.1 Professional Organisations

Professional organisations, or groups of economic interest (GIE's) are a typically a common feature of the agricultural sector. Various cooperative unions, producer federations, groups and associations all work in some way to organise farmers at the local, regional and national level. However, vegetable production is green beans and sweet corn is still too nice to have very meaningful representation in the system of GIE's.

However, as these farmers tend to grow these vegetables as a secondary crop, it's important to consider their membership of other GIE's related to primary crops. Onion and rice associations (near Saint Louis along the Senegal River Valley) for example are amongst the strongest and most organised in the country. These would be useful entry points to work with farmers in Senegal. Some of the more active professional organisation in onions and potato are listed below:

Figure 65 Overview of Active Professional Organisation in the Onion and Potato Chain

Potatoes	Onions
<ul style="list-style-type: none"> <li>• Book ligueye Notto gouye diamma</li> <li>• APMK Association des producteurs Maraîchers de Kayar</li> <li>• GIE des Producteurs Maraîchers de Kayar</li> <li>• Association des Producteurs Maraîchers de Fass Boye</li> </ul>	<ul style="list-style-type: none"> <li>• UGPAR (Union des Groupements et Agriculteurs de Rao)</li> <li>• UFMT (Union Forestière et Maraîchers de Thieppe)</li> <li>• APOQ ( Association des Producteurs d'oignons de Qualités de Potou)</li> <li>• UGPM (Union des Groupements des Producteurs de Mboro)</li> </ul>

### 4.6.2 Banks and Microfinance Organisations

Local banks do provide financing to larger producers, but for large integrated producers it is cheaper to organise finance in the Eu where the interest rate is much lower. In theory small scale vegetable farmers are able to access financing through the **CNCAS**. However, the vegetable market is very small, with no clear signs that there is momentum building in demand. In fact, since the early 2000s when food safety controls were tightened in Europe, production has declined. As a result, self-financing is largely required for working capital related to vegetable production. However, fixed assets investment can be financed through other crops such as onions or rice via the microfinance organisations active in the onion sector. But in Senegal a combination of low appetite for risk and high interest rates as well as low awareness of available products means that most farmers avoid formal credit products. In reality most farmers who are not able to self-finance, get financing from traders or personal networks. Where they are interested in pursuing financing from the banking system then tend to turn to micro-finance organisations.

PARMECAS, and the Union Financiers Mutualiste are some of the MFI's extending loan products to small scale farmers. These institutions offer unsecured lending, at 16% interest per year with a payback period of 3 years for investments in equipment or working capital for inputs. The growing

popularity of solar irrigation- and the fact that it makes good business sense- means that this has become an important area of activity for these MFI's. These MFI's tend to work with the input and equipment suppliers, who provide interest free loans to the MFI's. They in turn conduct an assessment of the producers' credit needs, provide advice and conduct an assessment of the general credit worthiness of the recipients.

The MFI's are also able to access funding from the Priority Investment Guarantee Fund (FONGIP).

#### 4.6.3 Agricultural insurance in Senegal

Agricultural insurance developed fairly recently in Senegal. The National Agricultural Insurance Company of Senegal offers a variety of insurance products in all agricultural sectors with the exception of livestock and fishing. Risks of crop failure due to flooding or (index insurance), to damage caused by birds, wildlife, etc. are some areas that are covered.

Large scale industrial producers tend to make use of this funding and insure their crops at 100% of the crop value. Small scale farmers, on the rare occasions that they take out insurance at all, insure only the inputs costs. This provides them some degree of protection from major losses, without eating too heavily into profits.

#### 4.6.4 The Knowledge Sector

Knowledge and skills development are two important supporting activities in the agricultural sector. The ideal is a combination of proactive research and development, which is then enriched and disseminated to professional education, vocational training and extension services. The challenge is however that development happening in the "vegetable" sector is driven by four private enterprises, which are closed by nature. The knowledge is not widely accessible nor widely disseminated.

Agricultural research and development falls under the remit of the Senegal Institute of Agricultural Research (ISRA), which in turn falls under the Ministry of Agriculture and Rural Equipment's (MAER) but operates as an autonomous unit. The Institute of Food Technology and the Universities of Dakar, Thiès, Saint Louis and Ziguinchor all contribute to knowledge development in the sector. Some private companies are also involved in research. For example, Tropicasem conducts applied research. This involves testing whether the available seed performs in the Senegalese environment.

The local knowledge developers listed above also work alongside international actors. For example, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) of the CGIAR and advanced research institutes and universities in Europe (e.g., the Institute for Research on Development, France) and North America (e.g., University of Florida).

As these specific vegetables are not a major crop in Senegal, they're not active in much related research and development, if any at all.

#### 4.6.5 Extension Services

The framework for extension services in Senegal are well provided for. However, as vegetables are not a staple foodstuff, they receive relatively little attention. Private-sector extension services delivered by input dealers is likewise relatively inactive apart from a few exceptional examples. For example, Bejo and Beemsterboer worked with small scale farmers for an onion outgrower model. Nevertheless, it's helpful to get a sense of the overarching system as it could provide routes for providing support in the future. So, a general overview is provided below.



Extension Services are designed to be coordinated and developed by **ANCAR**. This state funded agency has extension staff in each of Senegal's 45 districts and 190 counties. However, a chronic shortage of funds means that there's been a high vacancy rate in the organisation since 2017. To support ANCAR, Special Regional Development Agencies (**SRDR's**) were established by the government. They operate in particular zones and on particular theme. For example, the Senegal River Development Agency (**SAED**) was created in in the Senegal River Valley to support the development of irrigated agriculture there. The Agency's advisory service employs 85 field extension staff equipped with motorbikes and 12 supervisors. Extension activities include participatory diagnosis, needs assessment, implementing activities and monitoring and evaluation. SAED receives funding from the government and is currently managing seven donor- financed projects funded by the African Development Bank, the French Development Agency, the Japanese International Cooperation Agency, the Korea International Cooperation Agency, the Kuwait Fund, the Saudi Fund for Development and the World Bank.

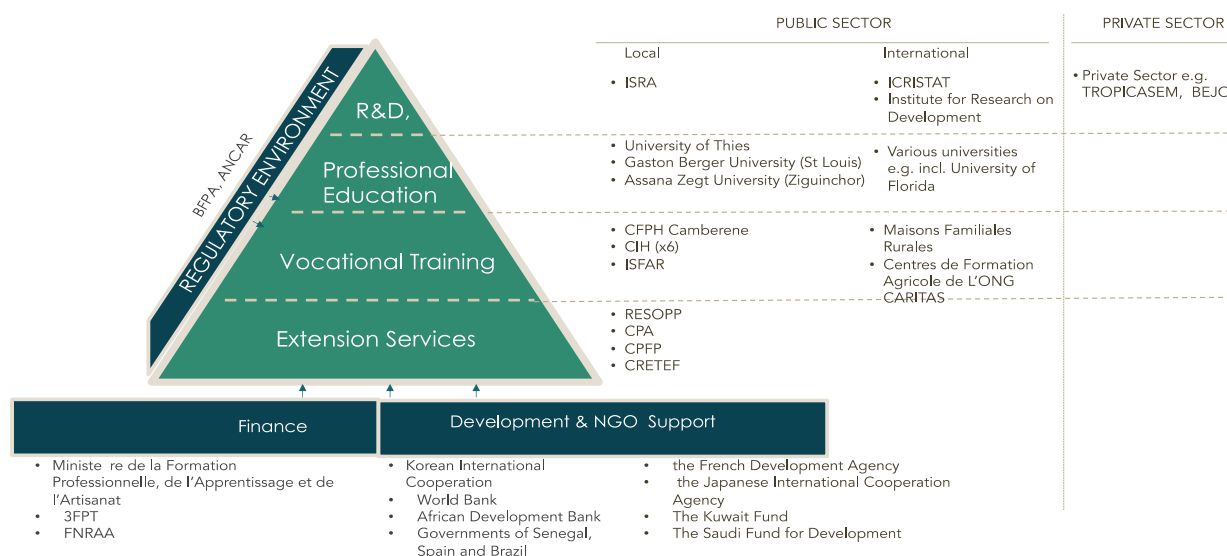
Another relevant agency is **ANIDA**. Founded in 2006, the National Agency for Agricultural is tasked with creating large, modern farms in "community agricultural domains," primarily to serve as employment opportunities for rural youth and to promote agricultural development. Twelve such domains are in operation and include over 100 farms. ANIDA employs 70 extension agents, who are supervised by 12 extension managers. Donors include the African Development Bank and the governments of Senegal, Spain and Brazil. In addition to extension services, these organizations provide a range of support including infrastructural development and supply of inputs.

Some professional and cooperative organisations provide training for their members. For example, RESOPP. This is a is a federation of farmer cooperatives, which offers training services to its member cooperatives as well as non-members. To realise this goal, they have training facilities in 8 out of the 15 regions in which Senegal is divided.

Centre Polyvalents de Formation des Producteurs (**CPFP**) & the Centres régionaux de formation technique et professionnelle, (**CRETEF**) provide training on agricultural techniques and innovative techniques for farming amongst other topics. These are targeted at producers.

The small scale of production and especially commercial enterprise related to these specific vegetables suggests that this is a small and relatively unimportant activity area for these extension services providers. However, should outgrower schemes become popular as a mode, local shoppers begin to look for these vegetables more often, or this be seen as a means to develop a more varied diet in Senegal, then this will need to be rectified.

Figure 66 Overview of Knowledge and Skills Development Actors in Senegal



Financing of skills development and research and development related to agriculture is provided by the National Agro-Food Research Fund of Senegal. This is a government agency established in 2004 that mostly funds research but has recently started funding dissemination of knowledge. The National Fund for Agro-Sylvo Pastoral Development (FNDASP) provides funding to support for the dissemination and large-scale adoption of technologies. They also fund projects that will expand the availability of certified seeds for priority sectors by promoting sustainable seed systems. Finally, bilateral and unilateral donor agencies such as the World Bank provide financing within specific programs e.g. The World Bank's funded West African productivity program.

## 4.7 Regulatory environment

The Bureau de la Formation Professionnelle Agricole (**BFPA**) is a service department of the ministry of Agriculture. They are responsible for coordinating agricultural and rural training policy in Senegal. Their ambition is to provide education to especially the rural population of Senegal by supporting and coordinating initiatives that improve agricultural education.

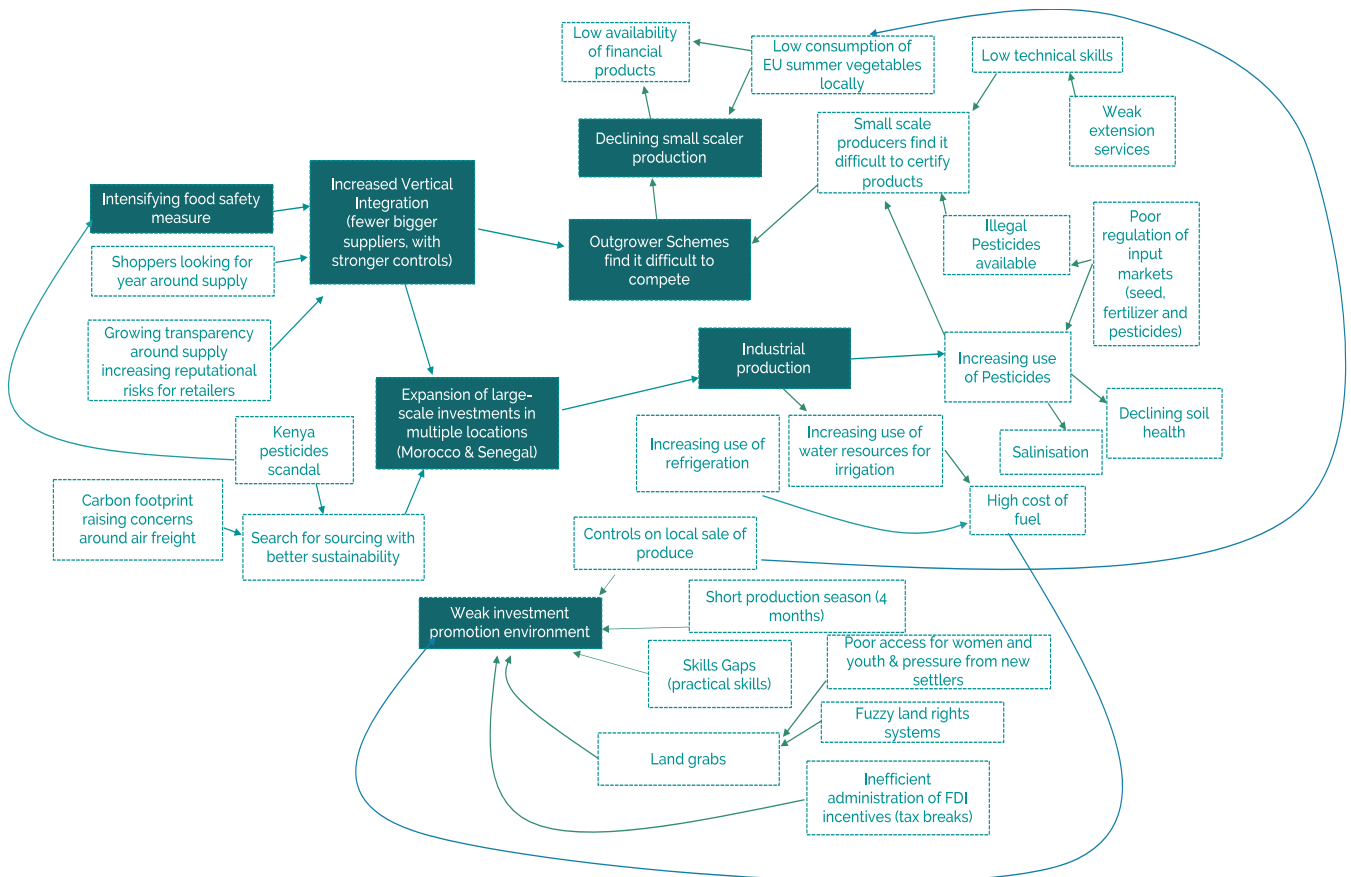
**ANCAR** is a parastatal that was formed in 1997 and given the role of providing advisory services throughout the country. ANCAR's mission is to provide a national system of rural and agricultural advisory services through improving advisory service delivery, harmonizing advisory methods, and facilitating a network of public and private advisory services. While the hope was that state funding would diminish over time, in reality it remains largely public sector funded organisation. In addition to providing advisory services, they also are to link farmers to the providers of inputs, credit, marketing and processing services.

## 5 Issues and Opportunities along the Value Chain

### 5.1 Overview

Figure 11 provides an overview of key issues and opportunities in the value chain and how they are linked together.

Figure 67: Overview of Issues and Opportunities in the Value Chain



## 5.2 Growing Demand For Green Beans And Under Supplied Market

The import statistics clearly illustrate there is space in the market for more exports, which can offer an opportunity to grow production. However, Senegal at the moment does not seem to be the preferred location for expansion due to the short production season and high start-up cost that make it difficult to earn back the initial investment.

## 5.3 Short Production Season

Production in Senegal is limited to 4 months. Yet export oriented models need a large investment in packaging and cooling facilities. This is a heavy burden for producers, many of whom are looking to how they can use their equipment and staff for longer periods in the year. This is where mango could offer interesting alternatives, whereas vegetable production could be integrated as a rotation crop for potato and onion farmers.

## 5.4 Expansion into Mango Production

The mango export season is complementary to that of vegetables and thus provides an interesting diversification alternative. Particularly because there is ample opportunity in the market to grow mango export.

SAFINA already has one of the largest mango plantations and arguably the best yielding plantation. GDS has planted 50ha of mango 4 years ago and has just started export. Export allows shared use of packhouses, harvesting crates, truck and tractors, cold storage and fixed staff. It also provides a source of revenue ahead of the new vegetable season.

### 5.5 Combination with Onion and Potato Production

Another opportunity to increase green bean and sweet corn production and export is to introduce this as a rotation crop to larger producers of onions and potatoes. These large producers engage in mono-cropping which is problematic particularly for potato production. From a disease management perspective there should be 2 to 3 crop cycles between two potato crops on the same land. Maize and particularly green beans are good rotation crops for potatoes and onions.

### 5.6 Silage Production from Crop residues and as Hot Season Rotation Crop

Availability of good quality fodder at affordable prices is by far the biggest challenge in the dairy sector in Senegal, as well as for animal fattening. Crop residues from sweetcorn and green beans can easily be turned into high quality silage, if the right techniques are used. In addition, in order to avoid salination and soil degradation it would be better to farm a rainfed sorghum crop in the hot season for silage production, or maize silage with limited supplementary irrigation.

### 5.7 High Start-Up Cost

Developing projects in Senegal at this scale requires major investments in infrastructure. Scrub and existing vegetation needs to be cleared, roads need to be built and in the Niayes, wells need to be drilled sometimes up to 120m deep.

There are also indirect costs that are often not included in the operational or start-up budget. For example, there are often administrative delays in issuing permits; staff arrive with theoretical skills but might need on-the-job training to be able to do the job. These delays slowdown that start up, while increasing complexity of start up for investors. All the while loans that have been taken out need to be repaid.

### 5.8 Fuzzy Land Rights And Land Grabs

In Senegal access to land of women and youth is challenging. At the same time the land rights system is complex and unclear. This creates tension between commercial farmers and local communities who see large industrial investors getting access to thousands of hectares of land. These developments also attract more labourers from around the country to these projects. This intensifies the competition for land access.

Many commercial farms invest in various community projects to build a social compact that allows them to farm the land unimpeded. This includes investing in schools, clinics, training programs for local farmers etc. But it's not always effective. In 2016 a "land grab" at the Senegindia farm highlighted to existing and prospective investors that more needs to be done to proactively manage community relations and improve the land rights framework.

One area where local Senegalese producers and lawmakers are particularly sensitive is in avoiding competition with industrial producers. Yet is this enough? Foreign investors are beginning to invest in local supply chains. Yet they remain fairly separate from the various groups of economic interest/professional associations that are ever-present in Senegal. It would be particularly helpful if some thought is given to how agricultural industrial investors can play a bigger role in disseminating production techniques and supporting agricultural services. These are all areas where small-scale famers in various value chains require support.



### 5.9 Limited incentives for Foreign Investment

Businesses have been promised various incentives in order to invest but through bureaucracy struggle to take advantage of them. For example, they struggle to import tractors and other equipment without having to pay import duties because it takes too long to get a permit. Meanwhile they are not allowed to sell produce on the local market.

A few locations are vying for the attention for foreign investors for counter-cyclical vegetable production. In fact, some of the investors in Senegal produce in other countries. Not being able to deliver against this hampers the ability to attract new investments, but also to stimulate the current investors to expand their investment in Senegal.

### 5.10 Lack of Technical Skills in the Local Labour Market

Farms struggle to attract staff with the right skills. Staff might have relevant qualifications, but often they lack practical skills and experience to be productive. As a result, these farms must provide significant on the job training before staff can become productive, or hire expensive expats. Some technical skills that are required and are often lacking are tractor drivers, tractor mechanics, irrigation repairs, agronomy, skilled packhouse managers etc.

### 5.11 Cost of Fuel

Irrigation and refrigeration all require energy. For example, water might be pumped up to 5km to reach the irrigation centre pivots on some parts of the farm. This is energy intensive and a substantial driver of costs. Irrigation costs are estimated to be 50% of the cost of production per ha, with 35% of that being fuel costs even when supplied by the national energy grid. The Senegalese power grid is can be unreliable at times, so large industrial farms are forced to resort to using more expensive back-up diesel engines to power this equipment.

### 5.12 Squeezing out of Small Outgrowers

Year-round supply has become an important part of securing market share for retailers. At the same time greater transparency and interest from shoppers around ethical supply chains and food safety has pushed retailers to look for new models of supply. For them working with fewer more vertically integrated producers with tighter controls over quality and supply chain risks is a huge benefit. They've also introduced more stringent food safety controls that require minimum certifications at the farm and packing facility level such as Global Gap, BRC, HACCP etc.

In the past small scaler supplied produce in outgrower models. Pressure from global trends has meant that only a few survive. Low technical farming skills and widely available illegal pesticides raises the risk of these farmers mis-stepping and jeopardising the reputation of Senegalese produce in the EU. As a result, the industrial producers have been lobbying the regulatory authorities to ban production of export vegetables via the outgrower model.

There is the possibility that these farmers will be forced out and will have to rely on the small local market. Consumption on the local market is low. Yet affordability and availability of quality vegetables are two ingredients to being able to grow consumption rates. The impact on farmer livelihoods and the required interventions to minimise any downsides would need to be considered.





### 5.13 Environmental Sustainability of Industrial Production

The commercial production of vegetables has a number of environmental concerns: Intensive cultivation increases disease pressure which in turn has resulted in greater use of pesticides.

- Seepage of minerals and chemicals into precious groundwater.
- Unsustainable use of scarce groundwater.
- Salination of soils.
- Soil degradation and loss of soil fertility.
- High levels of food wastage due to rejects not being sold on the local market.

These issues have been discussed earlier in the document under industrial production and will be discussed in greater detail in the next chapter.

## 6 Environmental Sustainability (Circular Economy)

In the wider sustainability context production for Europe in winter months is better done closer to Europe. As a result, production in Morocco and Senegal have many advantages than production in Kenya, which relies on air freight and has also seen pesticide residue scandals. Senegal has a dried climate with lower disease pressure, requiring less pesticides.

However, as we discussed earlier in this report the agri-ecological conditions in Senegal create an environment that is fragile and particularly vulnerable to climate change. Soil degradation, salination and unsustainable use of groundwater are major issues.

Intensive cultivation increases disease pressure which in turn has resulted in greater use of pesticides. Secondly, there's increased irrigation, which is an essential in the Niayes and the Senegal River Valley area. Over time these irrigated and fertilised soils create seepage of minerals in to the precious groundwater.

This issue is especially critical in the Niayes region, where the underground water reserves being used for agricultural purposes feed the city of Dakar, or where city water is being used to irrigate crops.

This scarce resource requires better management. Firstly, to ensure that farms use only the least amount of water possible for successful cultivation. Secondly, that there is some planning made for summer crops to keep the land in use. Finally, a longer-term planning is required to ensure that water resources are used sensibly. Without well thought through water and land management continued salination can be expected.

Industrial cultivation is typically intensive. As a result of continued use many rely on pesticides to manage increased disease pressure. While current levels of pesticides might be within the EU pesticide residue norms, it's important to also be sensitive to the impact of using these pesticides, which are being used increasingly, on the health of the soil.

Small scale producers also access pesticides that are no longer sold in the EU. These are often outlawed because of their impact both on food safety as well as on the environment. Getting better control over the availability and sale of these ostensibly controlled pesticides would be helpful in protecting the fertility of the soil for the future.



Another issue is waste. The specific tax regimes under which these businesses typically benefit prevents sale of more than 20% of production to local markets. This is intended to protect local producers and encourage exports. As a result, waste in this chain is significant. For example, Kenyan producers estimate that waste from green bean production is 30%. Sweet corn producers in Senegal have over 5000 tons of waste per week from this crop alone.

Some producers have tried to sell this as **silage**. This ensures that this waste is still used productively, but poor quality due to poor techniques has limited success.

Energy costs for industrial producers in Senegal are quite high. They need to invest significant amounts for energy for irrigation pumps and refrigeration. Barfoots SCL has invested in a **bio-fuel** energy generation. They use waste from their packing facility- estimated at 70 000 tons per year for sweet corn alone- to supply energy for their entire operation. They then sell excess energy to the grid.

## 7 Socio-Economic Development (Food Security, Employment, Women And Youth)

Introducing new types of vegetables are key mechanism to provide some resilience to households in Senegal. Yet, in Senegal the local food supply chain is largely separate from the export supply chain. This keeps affordable, quality reject vegetables out of the local supply chain. This has some advantages in that it protects small scale vegetable producers from competing against industrial producers, who in essence could be dumping waste on the local market. But it does also prevent these vegetables from becoming more readily available.

This industrial model of vegetable production also separates the input provision to these farms from the local input supply chain. Nevertheless, there are some benefits. Exports contribute to healthier trade balances with the EU. They also contribute significantly to local employment. A single large industrial producer can employ in excess of 10 000 employees. Many of these are temporary workers who are hired over the harvest period. In some cases workers travel from far flung corners of Senegal such as the Casamance. This brings much needed revenue to these areas, just as the farmers begin to prepare their lands for the wet season production.

Labour on these farms demographically skews towards women. They tend to be more involved in activities in packhouses- where their better attention to detail gives them advantages in sorting of vegetables. On some farms, women make up a substantial share of the work force. Van Oers Senegal suggest that they hire 4000 women to work on the farm<sup>12</sup>. While the GDS farm employs roughly 22% women on their farm near Saint Louis.



In some respect the job training offered on these farms is helpful to the youth. They tend to be hired as tractor drivers, training to provide mechanic services, to manage the irrigation systems etc. As a part of their corporate social responsibility initiatives many of these farms offer internships for local communities. In a small way these are helpful in addressing the skills development needed by the youth.

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<sup>12</sup> Onderzoek naar de mogelijkheden voor Nederlandse bedrijven in de agrarische sector van Senegal. Ministerie van Buitenlandse Zaken, Nederland



Figure 68 Women's Participation in the Labour Force for 3 Producers

	Barfoots SCL	Grand Domaine de Senegal (Compagnie Fruitière)	Van Oers Senegal
 Employees	1500 2000 (harvest)	3000	unknown
 Women	unknown	660	4000 (harvest time)

## 8 Options for Intervention

### 8.1 SWOT Analysis

<p>Strengths:</p> <ul style="list-style-type: none"> <li>– Large industrial investors with market access</li> <li>– Good control over quality, food safety etc</li> <li>– Land and water available along the Senegal River Valley</li> <li>– High use of manual labour for harvest</li> <li>– Agri-insurance products exist for industrial producers</li> </ul>	<p>Weaknesses:</p> <ul style="list-style-type: none"> <li>– Food safety measures increase demands for certification of improved food safety controls.</li> <li>– Outgrower schemes with small scaler models are increasingly squeezed out.</li> <li>– Increasing use of irrigation, fertilisers and pesticides and the resulting impact on soil health</li> <li>– Increasing salinisation of the soil</li> <li>– Poor investment climate (land rights, administration of incentives, practical skills gap)</li> <li>– Producers in the Niayes relying on groundwater, which feeds Dakar</li> <li>– High cost of fuel for irrigation</li> <li>– Low access to credit products</li> </ul>
<p>Opportunities:</p> <ul style="list-style-type: none"> <li>– Large market potential</li> <li>– Increased pressure for lower carbon footprint sourcing in the EU</li> <li>– Pesticide scandals in Kenya &amp; the demand for tightly controlled production closer to Europe</li> </ul>	<p>Threats:</p> <ul style="list-style-type: none"> <li>– Declining soil fertility</li> <li>– Increasing pest pressure requiring heavier doses of pesticides</li> <li>– Land rights remain fuzzy- especially as this results in land grabs</li> <li>– Outgrower models using small scale producers create risks of pesticide residue scares in Europe.</li> </ul>

## 8.2 Interventions (SDG Goals and Impact, Dutch Transfers)

The global trend towards industrial production in this chain is clear. It suggests that intervention should be focussed on expanding production in industrial systems through increased investment promotions and more sustainable production.

At a sector level better land, water and soil fertility management would be helpful. This has 3 areas of action. Firstly, at a regulatory level more needs to be done to proactively plan for development. This should include better use of water resources, where to encourage investment and what this means for water management systems. On a second level the regulatory authorities need support in developing and implementing water use policies and legislation and in regulating the use of fertilisers and pesticides etc. This should apply to both large scale and small-scale farmers. Finally, the question of salinisation specifically needs to be tackled. This includes investing in research and development as well as training (professional and extension services) around sound practices to reduce salinisation.

To expand investment in the sector more needs to be done to ramp up investment promotions efforts and tackle the barriers to investing.

Clarifying the land rights framework is an essential step to reducing friction around access to land. Better land management and planning will go some way to ensuring that local communities are less in conflict with industrial producers. Finding space for women and youth to participate in various value chains- export and local all-important ingredients to managing a potentially volatile situation. Finally, these industrial producers could use their corporate social responsibility activities to tackle the impact of small-scale producers who are being forced out of the export chain. For example, providing extension service for local vegetable production, investing in developing training centres, internships or open days; loaning of mechanisation equipment, or investing in mechanisation services. Whatever the solution, these investors need to consider the impact of their separation from the local value chains on the social compact between themselves, the community around them and small-scale farmers in general.

Another key area is to tackle the weakness in delivering incentives to investors. This requires that administrative inefficiencies be reduced and that processes are simplified so that exporters can benefit from promised exemptions and tax benefits. When it comes to investment promotion, more needs to be done to develop and promote projects for potential foreign investors, who could be looking to shift production from Kenya, or expand from Morocco or Egypt to Senegal. Some potential solutions that seem to be working in other African countries are developing one stop shop services for foreign direct investment. These should act as trouble-shooters as well as look in to developing near shovel ready development projects for investment promotion. Some key issues that can be tackled in the project scoping are land rights, infrastructure, land and water usage planning etc. Investment promotions projects in other developing countries provide some lessons for Senegal and could be considered. These agencies bring “shovel ready projects” to the attention of investors. This includes scoping out the project scale and location, getting permits and exemptions ready and in some case providing some basic infrastructure for the development.

Some additional supporting interventions would be tackling the question of high waste and high energy costs related to irrigation. Expanding the practice of using waste as bio-fuel or silage for the dairy sector is one means by which these costs can be reduced. It also has the added benefit of



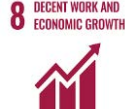
providing energy to an unstable power-grid. Another mechanism to reduce waste and increase the environmental sustainability of these projects, might be sensible to promote mixed crop production models. For example, a winter season of onions, potatoes and vegetables in rotation, followed by silage in Summer.

Finally, practical skills development is an important area. At a sector level more needs to be done to ensure that professional and vocational training becomes more practical. Another potential intervention is working with existing vocational training centres to expand their offer of practical training. In the South African sugar industry major producers contribute to a training centre that provides training on these much-needed skills.

### 8.3 Overview of Proposed Interventions

Bottlenecks	#	Interventions	Fit with Dutch Knowledge , Strategic interests etc.	SDG Goals
Large market potential, but competition from the Maghreb as an investment location.	1a	Support APIX to develop capacity for project scoping, investment promotions and troubleshooting for FDI (new and expansion).	***	1,2,8
Gaps in the delivery of various incentives offered to investors.	1b	Strengthen administrative capacity to accelerate issuing of permits, troubleshooting etc	**	
Declining soil health due to increased use of pesticides and irrigation.	2a	Invest in knowledge development around salinisation management, crop rotation, water reduction etc. Engage industrial producers around sustainable production. Integrate in to regulatory mechanisms.	***	13,15
Water & Land Management.	2b	Strengthen Senegalese capacity around water and land management. This should include scoping of production zones (which crops, where, using which water sources) & ability to develop and enforce regulations.	***	
Practical Farming Skills.	3a	Support training institutions to develop practical skills courses. Potentially develop sector training centre to provide training for skilled labour.	***	1,2,4, 5
Waste from industrial production can't be sold as food.	4	Support the development of silage and bio-fuel models.	**	12

### Sustainable Development Goals



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economic | business | development

**SENSE**

## Value Chain 5 - Poultry and Eggs



## 1 Executive Summary

Many Senegalese rely on marine fish for the bulk of the animal protein in their diets. Increasing pressure on marine fish stocks is thus a particularly important issue. Protecting and replenishing these fish stocks is needed. However, alternatives also need to be developed. Eggs and chicken meat are gram for gram the next most affordable animal protein after sardines, which many would consider the national food of Senegal. Over the last decade poultry production has made a leap forward- both in terms of volumes produced and in the means of production. Today, most chicken is produced in a highly efficient large agro-industrial model. Small-scale producers have shifted to broiler production using imported genetics. The port of Dakar provides imported feed ingredients at competitive prices to producers, the majority of whom are clustered nearby along the coast and in Thiès. Sedima, the largest producer of chicken and eggs, now also produces hatching eggs locally. This increases the possibilities for local small-scale producer who already have ready access to imported supplies. This has created a relatively professional and efficient production model with feed conversion rates in line with global norms.

Some would argue that the development of production has far outpaced the ability of the market to absorb these chickens and eggs. Large industrial chicken producers in other countries have the luxury of being able to direct excess production volumes to the processing and food services (Hotel Restaurant and Catering) chain. In Senegal this is not the case. The market is oriented towards live chicken sale in open markets with few-if any- refrigeration points. The food services sector is small and processed chicken products are virtually unheard of. As a result, competition for market access is intense and intensifying. Large producers find themselves hemmed in by a lack of market development and outlets for their frozen chicken, but, having made significant fixed asset investments to ramp up their scale and produce competitively. For smaller commercial farmers oversupply means longer gaps between the end of the production cycle and the sale of the birds. This “over-run” has dire consequences for profitability because every day a fully-grown chicken is kept alive is money lost on feed. Furthermore, it reduces the number of production cycles per year. Any time there is a dip in demand the producers hold on to the birds that bit longer, affecting their ability to clear the cages and start a new rotation. If birds could be processed and frozen there would more flexibility in the system.

This strain in the market creates a cap on the scale of small-scale producers. At a scale below 2000 birds they can market their birds and eggs reasonably well. Any larger and this is not the case. Scaling up also requires greater investment in cooling to ensure that production can happen year around. The consequences are clear. There are few producers who produce at this middle scale. There seems to be some sense in identifying what can be done to help small scale commercial producers make a leap rather than a stepwise transition from small to medium and then large industrial scale.

It seems that stimulating the growth of small-scale producers without solving the marketing issues would only intensify pressures on existing producers. The key issue is therefore how to develop the market built around live chickens with no processing of chicken and eggs and a small food services sector?

There's a big overlap between broiler and egg producers in Senegal. As with broilers, egg production is similarly hampered by a lack of processing market. In modern egg production systems this sector absorbs the vast majority of eggs. This creates regular boom and bust cycles

for producers who are enticed in to egg production by rising prices and low barriers to entry in the egg market. Then as the market nears saturation, prices fall leaving many producers unable to sell their excess eggs. Producers exit, creating conditions for lower availability of eggs and rising prices. This begins the cycle anew. Finding an answer to the processing gap is thus critical to ensuring that the boom bust cycles regularly seen in egg production is broken.



## Résumé Volaille et oeufs

De nombreux Sénégalais dépendent des poissons marins pour l'essentiel des protéines animales dans leur alimentation. La pression croissante sur les stocks de poissons marins est donc un problème particulièrement important. Il est nécessaire de protéger et de reconstituer ces stocks de poissons. Cependant, il faut aussi développer des alternatives. Les œufs et la viande de poulet sont, gramme pour gramme, la protéine animale la plus abordable après la sardine, que beaucoup considéreraient comme l'aliment national du Sénégal. Au cours de la dernière décennie, la production de volaille a fait un bond en avant, tant en termes de volumes produits que de moyens de production. Aujourd'hui, la plupart des poulets sont produits en suivant un grand modèle agro-industriel très efficace. Les petits producteurs se sont tournés vers l'élevage de poulets de chair en utilisant de la génétique importée. Le port de Dakar fournit des ingrédients d'aliments pour animaux importés à des prix compétitifs aux producteurs, dont la plupart sont regroupés à proximité de la côte et à Thiès. Sedima, le plus grand producteur de poulets et d'œufs, produit maintenant aussi des œufs à couver localement. Cela augmente les possibilités pour les petits producteurs locaux qui ont déjà un accès facile aux fournitures importées. Cela a créé un modèle de production relativement professionnel et efficace avec des taux de conversion des aliments pour animaux conformes aux normes mondiales.

Certains diront que le développement de la production a largement dépassé la capacité du marché à absorber ces poulets et ces œufs. Les grands producteurs de poulets industriels d'autres pays ont le luxe de pouvoir diriger les volumes de production excédentaires vers la chaîne de transformation et de services alimentaires (hôtellerie-restauration). Ce n'est pas le cas au Sénégal. Le marché est orienté vers la vente de poulets vivants sur des marchés ouverts avec peu ou pas de points de réfrigération. Le secteur de la restauration est petit et les produits transformés à base de poulet sont pratiquement inconnus. En conséquence, la concurrence pour l'accès au marché est intense et s'intensifie. Les grands producteurs se retrouvent coincés par un manque de développement du marché et de débouchés pour leur poulet congelé, tout en ayant fait d'importants investissements en immobilisations pour augmenter leur échelle et produire de manière compétitive. Pour les petits exploitants commerciaux, l'offre excédentaire signifie des délais plus longs entre la fin du cycle de production et la vente des volailles. Cet excédent a des conséquences désastreuses sur la rentabilité car chaque jour où un poulet adulte est maintenu en vie est de l'argent dépensé pour son alimentation. En outre, cela réduit le nombre de cycles de production par an. Chaque fois qu'il y a une baisse de la demande, les producteurs gardent les volailles un peu plus longtemps, ce qui affecte leur capacité à vider les cages et à commencer une nouvelle rotation. Si les volailles pouvaient être transformées et congelées, le système serait plus souple.

Cette tension sur le marché crée un plafond à l'échelle des petits producteurs. À une échelle inférieure à 2 000 volailles, ils peuvent commercialiser leurs volailles et leurs œufs raisonnablement bien. S'ils produisent à une plus grande échelle, cela n'est plus possible. La mise à l'échelle nécessite également des investissements plus importants dans le domaine du refroidissement afin de garantir que la production puisse se faire tout au long de l'année. Les conséquences sont claires. Il y a peu de producteurs qui produisent à cette échelle moyenne. Il semble judicieux d'identifier ce qui peut être fait pour aider les petits producteurs commerciaux à faire un bond plutôt qu'une transition progressive de la petite à la moyenne puis à la grande échelle industrielle.

Il semble que stimuler la croissance des petits producteurs sans résoudre les problèmes de commercialisation ne ferait qu'intensifier les pressions sur les producteurs existants. La question clé est donc de savoir comment développer le marché construit autour des poulets vivants sans transformation des poulets et des œufs et en disposant d'un petit secteur de la restauration.

Il y a un grand chevauchement entre les producteurs de poulets de chair et d'œufs au Sénégal. Comme pour les poulets de chair, la production d'œufs est également entravée par l'absence de marché de la transformation. Dans les systèmes modernes de production d'œufs, ce secteur absorbe la grande majorité des œufs. Cela crée des cycles réguliers d'expansion et de ralentissement pour les producteurs qui sont incités à produire des œufs par la hausse des prix et les faibles barrières à l'entrée sur le marché des œufs. Puis, alors que le marché approche de la saturation, les prix chutent, empêchant de nombreux producteurs de vendre leurs œufs excédentaires. Les producteurs se retirent, créant ainsi les conditions d'une baisse de la disponibilité des œufs et d'une hausse des prix. Le cycle recommence ainsi. Il est donc essentiel de trouver une réponse au problème de la pénurie de transformateurs afin de rompre les cycles d'expansion et de ralentissement que l'on observe régulièrement dans la production d'œufs.



## 2 Background and Method

The aim of this study is to provide insights into the Senegalese poultry value chain and to define critical interventions that are needed for the sector to flourish. Ultimately it is hoped that these interventions will play a useful part in fueling an improvement in the livelihoods and food security of the Senegalese people, while improving the lot of women and youth and the environment.

More specifically the study aims to (i) describe the market, production and enabling environment in the onion chain in Senegal (ii) reveal the key issues, opportunities and bottlenecks in the value chain (iii) propose specific interventions that can help to address these bottlenecks & allow for the value chain to have greater impact (iv) identify areas where inclusive participation of women and youth in the economy can be stimulated (v) highlight opportunities for improved circular economy practices (vi) recommend areas where public, private and the knowledge sectors can make valuable, if not unique, contribution to these interventions.

The study involved 3 distinct phases. Firstly, desk research was conducted to understand the existing knowledge and open questions when it comes to the poultry value chain. This was supported by interviews with subject matters experts. Generally, these were people, businesses or institutions who provide supporting services, knowledge development or institutional support in the agricultural sector in Senegal. To get a better understanding of Dutch expertise and strategic and commercial interests, interviews were conducted with businesses who trade with Senegal, professional sector organisations, research institutes or service providers who offer knowledge services in aid of Senegalese agricultural development etc. To include insights on poultry market development in African countries, we consulted a South African poultry expert who has experience in providing technical support to various commercial poultry firms in the region. Experience from the UAE enabled us to gather insights in to production in high heat environments.

In step 2 we carried out field research in area surrounding Dakar and in Thiés. Thereafter, in step 3, interviews were carried out with 75 consumers, 15 traders and representatives in 3 cities/town in Senegal viz Dakar, Thiés and Pikine. 5 representatives from the Hotel restaurant and catering field (HoReCa) were interviewed in Dakar.

We must highlight that this research was carried out during the COVID 19 period, but after local constraints on travel were lifted. This has both advantages and disadvantages. A large number of interviews could be conducted telephonically, which made including a variety of perspectives and experiences from Senegal and the Netherlands far more possible. In some instances, the new “work from home” norm made interviewees more available. Nevertheless, access to farms, industrial producers, financial institutions, input suppliers etc. was possible during the fieldwork. These greatly enriched the quality of insight reflected in this report.

## 3 The Market

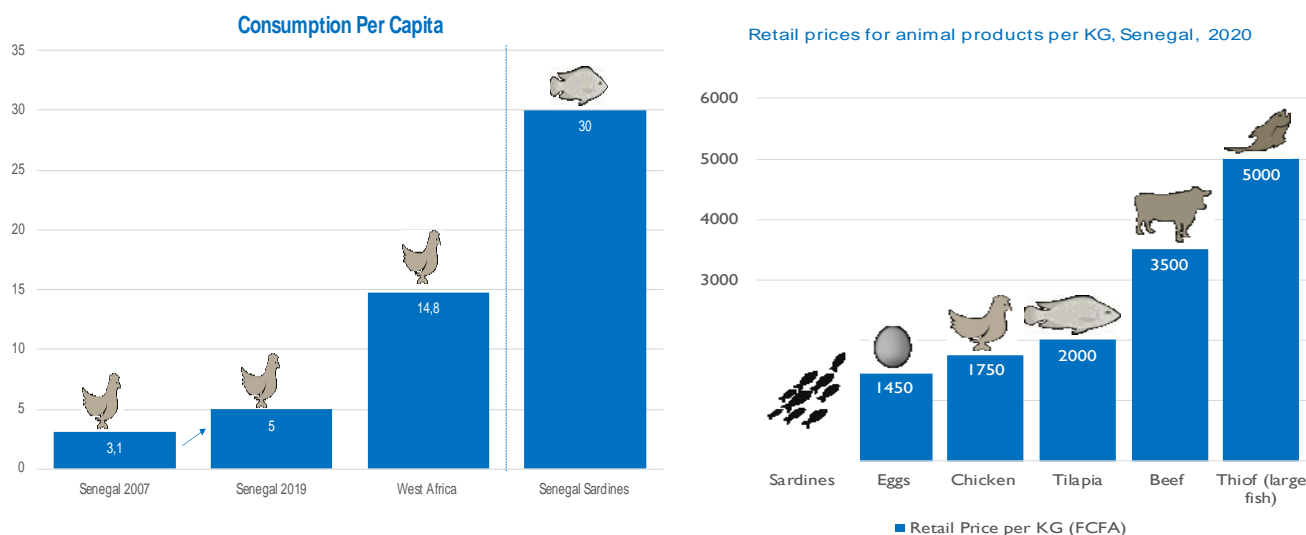
### 3.1 Chicken Meat

Per capita consumption of chicken has grown from 3.1 kg per capita in 2007 to almost 5 kg in 2019 but is still lower than the West Africa average of 14.8 kg per capita. About 70% of animal protein consumed in Senegal is marine fish, with an annual consumption of almost 30 kg per capita. Typically, chicken is consumed weekly or biweekly as it introduces some variety into the diet



(consumer research 2020). It's also consumed at events and festivities and is prepared for guests and the more special occasions in the year.

Figure 69: Consumption Per Capita of Poultry and Retail Prices of Various Animal Protein Products



Affordability plays a large role in consumption patterns of chicken. Yaboy (sardines), are widely available in local markets and can be bought for 30% of the cost of chicken.

The retail price for a chicken is around FCFA 2500 per bird (FCFA 2575 when plucked). The retail price per kg is around FCFA 1750, 3 times greater than sardines (FCFA 500/kg)-which is a sizeable increase in cost. As a result, it's eaten relatively infrequently. The entire bird is required to feed a family for 1 meal, so birds weighing at least 2.5kg live (2kg plucked) are clearly preferred.

A ban on chicken imports instituted in 2005 means that the poultry consumed is locally produced. Low trade statistics for Senegal and neighbouring countries suggest the ban is effective. Over 90% of Senegalese purchase poultry from open air markets. As in other African countries with import bans, most chicken, is bought live and then slaughtered and plucked at the market. Estimates suggest that at present this represents 70% of the market. In Dakar chilled chicken i.e. slaughtered is increasingly available. Upper income consumers who represent about 10% of the population can buy pre-packaged frozen or chilled chicken meat at modern retail stores. The supermarket and food services sector purchases from the large companies that use more professional abattoirs, e.g. Sedima.

### 3.2 The Market for Eggs

Egg consumption has grown in Senegal. Between 2017 and 2010, yearly consumption of eggs increased from 35 to 50 eggs per capita, largely because of growth in production. Typically, eggs are eaten in the morning for breakfast. Traditionally, Senegalese would use eggs to prepare mayonnaise at home. However, increasingly this is being replaced with imported packaged mayonnaise.

Despite the strong growth, egg consumption in Senegal is still low (around 50 eggs per annum per capita, compared to 230 in the EU and US). In part the low consumption of eggs could be caused

by the smaller size of the food processing industry. In the EU and US a large part of eggs are used as ingredients in the food industry. Eggs retail for 100 FCFA per egg. As with chicken meat, eggs are more expensive than sardines and so they are considered relatively expensive.

The chicken ban extends to the import of eggs. As a result, the eggs available in Senegal are local eggs, but from imported chicken breeds.

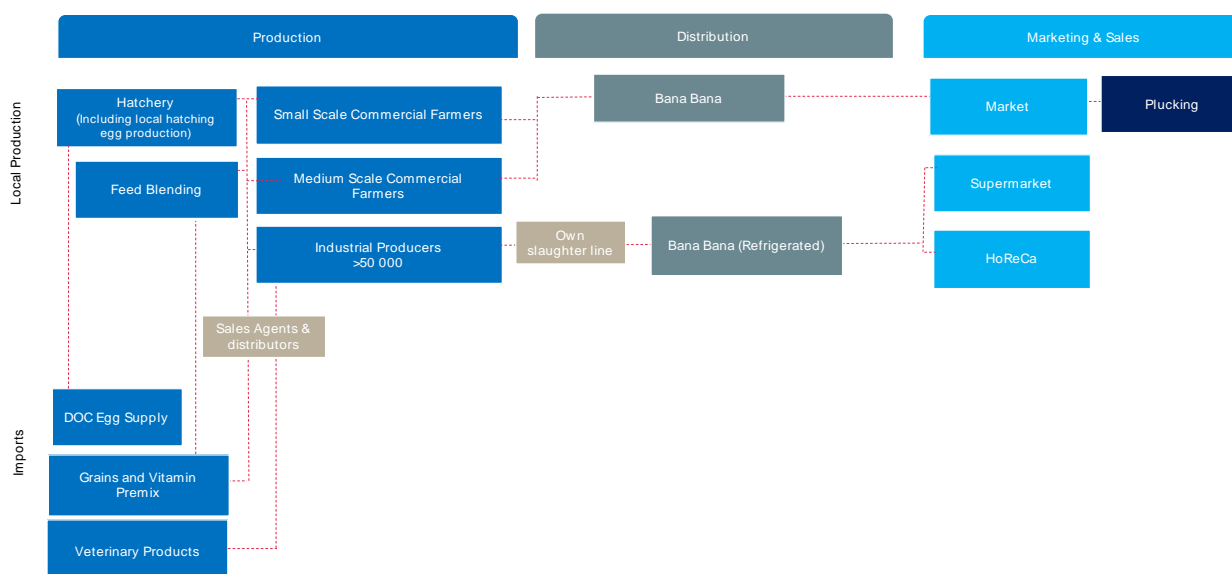
The start of the rainy season and Tabaski are two critical periods in the production calendar for small scale producers:

- In the rainy season small scalers typically sell off their flocks as it is a period with higher disease pressure. This sell off creates over-supply of live chickens in the market and prices fall.
- During Tabaski many families slaughter goats. In the period thereafter, they consume this meat and demand for chickens then falls. Many small-scale farmers aim to time production so that they miss this period.

Peak demand periods are in the run up to Ramadan or to the end of year celebrations.

## 4 The Structure of the Value Chain

Figure 70: Structure of the Value Chain





## 4.1 Poultry Production

### 4.1.1 Growth of the sector

The growth of domestic production since 2005 has been spectacular. According to some sources, annual growth between 2005 and 2013 was 14.7% and 25% between 2016 and 2019. Recent estimates suggest that 53 million chickens, largely broilers, were produced in 2019. Most are produced by commercial broiler farms. Layers, who have reached the end of their production cycle, are also sold as chicken meat (6800 tons, USAID).

Chickens grow slower and mortality rates are higher at high temperatures. As a result, poultry commercial broiler farms are mainly located along the cooler Senegalese coast in the Niayes zone.

In the informal sector backyard producers use local and broiler breeds of chicken that are fed with local agricultural by products such as maize bran, or sometimes with some improved feed. Local chickens take about 6 months to grow and are sold for substantially higher prices because they are appreciated for their flavour.

Growing production volumes have come about largely because of increases sophistication in the commercial sector. Here, small scale commercial producers compete alongside large commercial producers and even an industrial producer.

Figure 71 Chicken Production Volumes in Senegal

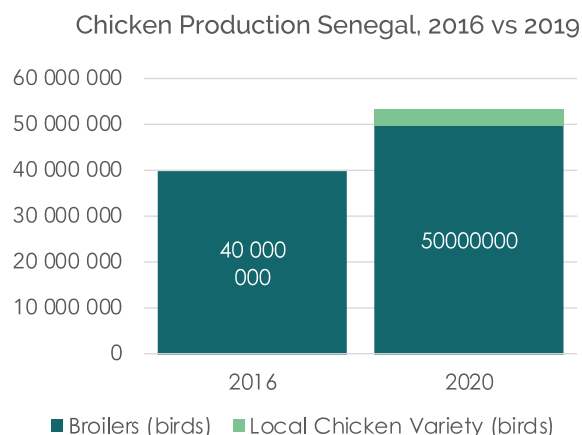


Figure 72 Broiler Production Locations in Senegal

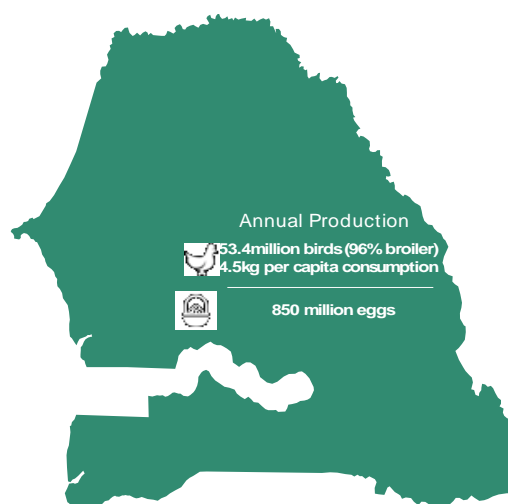



Figure 73 Commercial Production Systems

	DOC producers Official	4500 Small Commercial Units	4-5 Large Commercial Units	1 Industrial Vertically integrated Producer
	20 official >50 unofficial	1000-2000 birds 1425kg-2850 kg	>10000 birds 14520-17100kg	120 000 birds
		<ul style="list-style-type: none"> <li>- Imported broilers</li> <li>- Open air sheds</li> </ul>	<ul style="list-style-type: none"> <li>- Imported broilers</li> <li>- Cooled shed</li> <li>- Own Slaughter Lines</li> </ul>	<ul style="list-style-type: none"> <li>- Imported broilers</li> <li>- Cooled shed</li> <li>- Own Slaughter lines</li> <li>- Lead farmer with Outgrower model</li> </ul>



#### 4.1.2 Informal, backyard producers

Most rural households raise chickens- both for meat and eggs. While some grow imported broiler breeds, they are also more likely to produce local chicken. The chickens are typical free range i.e. they are allowed to roam freely in backyards. Generally, broilers are vaccinated, and some degree of water and supplementary feeding is provided.

These chickens and eggs are then used by the family, are served to special guests at special occasions, or are traded or sold to neighbours.

#### 4.1.3 Small Scale Commercial Broiler enterprises

The **smaller commercial units** produce on average 1000 birds per 45-day cycle. Some produce up to 2000, but this is less common. These birds are stored in open air sheds. At the small end of the production scale these sheds are fairly rudimentary.

Though in Senegal this is the least developed commercial producer group, their production system is often more sophisticated than that seen in the rest of Africa. They produce almost exclusively broilers, using imported day-old chicks; invest in vaccination and quality feed using imported ingredients. As a result, they're capable of producing chickens with feed conversion rates very much in line with norms in more developed poultry markets (1.6 kg of feed: 1kg of chicken).

Small scale farmers are particularly affected by the rainy season and the Tabaski period. They don't have the climate-controlled sheds that are needed to manage disease pressure during the rainy season. The heat also affects layer hens, who slow down or stop laying altogether. To avoid losses and low return on investment small scale farmers typically stop production and sell off the birds and eggs that they do have.

The steep decline in demand during Tabaski period also creates pressure on these farmers. They need to avoid ending their production cycle in this period, or they could be stuck with chickens.

#### 4.1.4 Large & Integrated Industrial Producers

Large commercial producers in Senegal are more likely to produce chickens in the "tens of thousands" rather than the thousands. As a result of this scale they have been able to adapt farming practices in line with what you would see in far more developed markets. Firstly, they use air-conditioned sheds that allow for production all year round. Secondly, they have their own slaughtering lines with a fair degree of automation. Finally, they have freezer facilities to allow for storage and the smoother marketing of chicken. These producers have good access to independent traders who market their products around the country, but especially in Dakar which has a more developed chilled chicken market.

At the very top of the Senegalese producers is a **large integrated producer**, Sedima. They are involved in all activities in the poultry production chain including hatcheries, breeding farms, a feed mill and a food processing factory. Sedima is also the market leader in egg production. They produce chicken and eggs on their own farm, have independent contract growers and also supply inputs such as day-old chicks to independent growers and egg producers. The Sedima Dakar farm is fully automated and produces about 120 000 birds per 45-day cycle. In addition, they produce broiler chickens in a controlled outgrower system. About 20 producers both small (1000-2000 chickens per cycle) and large (>50 000 chicken per cycle) are in their system. Sedima provides all

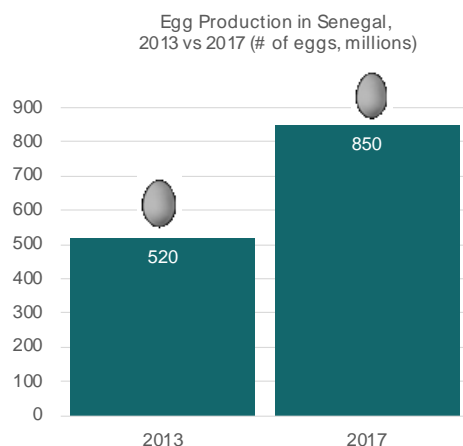


the inputs as part of the contract and purchases the birds. The food services sectors (restaurants, hotels, caterers) as well as for formal retail (Auchan) are almost entirely served by Sedima.

## 4.2 Egg Production

About 520 million eggs were produced in 2013 in Senegal, with an annual growth of 6% from 2005. In 2017, according to a different source, allegedly 850 million eggs were produced, which would mean 13% growth per annum between 2013 and 2017.

Figure 74: Egg Production in Senegal



About 60 percent of eggs are produced by commercial farms. These are farms that have an egg production facility with egg processing and use imported genetics and modern production techniques such as battery cages and occasionally automated systems. Typically, there's a big overlap between the producers of chicken and eggs—especially at the level of small-scale backyard producers and larger commercial units. The eggs are sold in urban markets in the Dakar and Thiès regions. According to government contacts, in 2016, three commercial farms, Sedima, Avi Boye, and Jai Lax Mi, compete for approximately 82 percent of the market. Larger farming

operations can raise more than 300,000 layers. Table eggs are sold to hotels, restaurants, and wholesalers/retailers in 24-count egg cartons.

The remaining 40 percent of eggs produced are from smaller farms or informal operations that allow layer chickens to roam free on the property. It is unclear how much of this small farm production is split between local and imported breeds.

Layer chickens are recycled after 18 months and sold to intermediaries for slaughter at around 1,000 FCFA per bird of about 1.5 kg.

## 4.3 Input Supply

### 4.3.1 Day-old Chick Suppliers

Since the ban on importing chicken meat there's been a dramatic move away from producing local chicken varieties. Where local chicken varieties are being kept, these tend to be backyard operations for eggs & occasionally layer meat.

Most commercial farmers have recognised that imported broilers have a higher feed conversion ratio and so make for far more competitive chicken production. As a result, day old chicks are largely from imported genetics. The import of hatching eggs is somewhat regulated, with importers required to get prior authorization from the Veterinary Services (DSV). This allows that checks can be carried out to ensure that the eggs are disease free. While this is open to any hatchery, in reality 2 importers are chiefly responsible for imports. These are Afitex and Invervolife.


The growth in production has stimulated growth- some would say uncontrolled- in hatcheries. In 2004, only 10 hatcheries had been established in Senegal. Today, there are more likely between 50 and 70 hatcheries operating- although only 20 of these are official.

The predominant breed of imported broiler hatching-eggs are Cobb 500 are Hubbard. These are sourced from Brazil, South Africa and India. Layer hatching-eggs come largely from Brazil. A variety of layer hens can be purchased which include Hisex, Hy-Line; Lohmann's etc.

Finally, the growth in the chicken market has catalysed investment in hatching egg production itself. The large industrial producer Sedima is now 70% self-sufficient and produces eggs from breeder stocks sourced largely France, Brazil and less often from the Netherlands. They still rely on imported eggs to close gaps created by peak demand periods e.g. productions in the run up to Ramadan or the end of year celebrations.

This local production comes at a major cost advantage. Typically, Sedima is able to retail day old chicks in Senegal for 250 FCFA, which is the purchase price of imported eggs from Brazil. The change to local hatching egg production could result in a halving of day-old chick prices when compared to those reliant on imported hatching eggs and to a country like Ivory Coast.

Figure 75 Day old Chicks Prices in Senegal & the Ivory Coast

	Day Old Chick Prices	
	Senegal	Ivory Coast
From local hatching eggs	*250 FCFA	**500FCFA
From imported hatching eggs	*440-650 FCFA	
Layers		700 FCFA
*Price of vaccinated day-old chicks.		
**Sourced from Poultry Sector Study Cote D'Ivoire, RVO.		

Despite the rampant growth of the day-old chick business and the more recent expansion of local egg production, a few large companies still dominate supply. Four companies service 86% of the broiler market, while 5 companies service 76% of the layer market. Some of the larger hatcheries have a capacity of 600,000 day old chicks per month. As a result, the market is well supplied. The largest hatcheries in Senegal are Sedima, AviSenegal, Avivet, ProDas and Jai Laxmi.

#### 4.3.2 Imported & Local Feed Ingredients

Feed is by far the biggest cost in modern poultry farming and within the feed it is the protein component that is most expensive. Getting a good control on feed quality and costs are thus essential ingredients of a modern, competitive chicken industry.

The feed system in Senegal is well developed. Eight feed millers are able to produce between 50 and 800 tons of feed per day each. Sedima, Olam, NMA Sanders and FKS Mills account for the bulk of the market, estimated at 300,000 tons/year. Starter mash, grower and finisher for both broilers and layer chickens are available from agricultural input dealers across the country. The good feed

conversion rates amongst large commercial operations suggest that the quality of the feed is good. The feed is also priced in line with producers in the Ivory Coast and Ghana.

Interestingly, it seems that Senegalese layers reach a higher weight than those in Ghana and Ivory coast at the end of the production cycle. After 42-49 days chickens in Ivory Coast are approximately 1.7 kg.<sup>13</sup> compared to 2.4kg in Senegal before plucking (final weight 2 kg). This suggests a difference in the quality of the available feed as well as growing conditions, but would need to be verified.

Figure 76: Comparison of feed cost in West Africa

	Costs Senegal	Ivory Coast	Ghana
Retail (Broiler)	12 400 – 15 000 FCFA	11 800-14 500 per 50kg bag* (varying prices for starter, grower and finisher)	13 300-14 200 FCFA ** per 50 kg bag
Retail (Layer)	12 200-13 000 FCFA		
Wholesale	12 000 FCFA		
*Sourced from the Poultry Sector Study Cote Ivoire.			
**Sourced from 2017 Ghana Poultry Annual Report , USDA GAIN.			

The major components of poultry feed available in Senegal is based on the traditional recipe of maize kernel and soybean meal. These ingredients are generally imported from major grain producing countries such as Argentina and Brazil. Vitamin concentrates and premixes are imported from the EU. Finally, limited amounts of local ingredients are used such as peanut meal and fish meal.

We have to recognize that Senegal is not competitive in farming maize and soybean due to the limited availability of water and land, and relatively low soil fertility. It is also questionable if these scarce resources should be used for animal feed production. The poultry industry will remain dependent on imported soybean (cake) and maize. However, the close proximity to the Dakar port, which is one of the largest in Africa, helps to control import costs. In that respect, the Senegal situation is comparable to a large developed poultry producer such as the Netherlands which is also highly dependent on imported soybean and maize.

#### 4.3.3 Veterinary Services




The quality, availability of veterinary services and products is good. Producers are able to access services from skilled service providers. Chicks are generally purchased vaccinated. As a result, disease outbreaks have been few and far between and have been very well managed.

<sup>13</sup> Poultry Sector Study Cote d'Ivoire, RVO

## 4.4 Route to Market

Chickens and eggs are largely sold via the informal market to consumers. Large industrial producers tend to focus on the food services sector or work with traders (bana-banas) who distribute live chickens to the markets.

Figure 77: Pricing in the Value Chain

	 Broiler, 2.5 kg live	 Medium Eggs 24 carton	 Large Eggs 24 carton
Plucking fee	+75 FCFA		
Retail Price (Market)	2500 FCFA	2500 FCFA	2500 FCFA
Wholesale Price	1700 FCFA	1400-1500 FCFA	1600-2000 FCFA

### 4.4.1 Traders (Bana Bana's)

As with many African value chains, traders play a critical role in getting produce from producers to the markets in Senegal. They purchase chickens and eggs at the farm level, and then sell these to retailers in mostly open markets.

Bana Banas in the poultry chain have a distinct preference for sourcing from larger producers. These supply the bulk of their orders, enabling them to source their chicken from a few collection points. Those bana banas then use smaller producers to supply the chicken that couldn't be sourced from the large producers. As these bana banas are the critical gateway to market, these relationships are well protected.

Generally, their trade is in live chickens, which still make up 90% of the market. At the start of the rainy season and Tabaski, the traders are aware that prices of chicken will fall. They use these moments to stock up on chicken, which are slaughtered in the farm before being taken to a "plucker" to have feathers removed. This chicken is then frozen and sold later in the season to "poissonerie" (fish stores) who also sell chilled or frozen chicken.

There are also some traders who are large enough to deal with the large commercial sellers. They generally supply to supermarkets e.g., Auchan and use refrigerated trucks to collect and distribute the chicken.

### 4.4.2 Retailers & Pluckers

Bana Banas, who mostly trade in live chickens, sell chicken and eggs to wholesalers or retailers in the markets. Typically eggs and chicken are sold at the same stall. In the case of live chicken these are stored in small cages or pens until they can be sold. The bird is then slaughtered, and the customer has an option of paying a "deplumeuse" to pluck, eviscerate and clean the chicken. This is carried out manually or using small machinery that helps with plucking.

Figure 78: Simple Artisanal Plucking Machine



In the case of manual plucking the chicken is dipped in hot water before being defeathered. Generally, this service, whether manual or automated, is offered near to the retailer for a small fee of 75 FCFA per bird.

For those chickens being sold to fish stores, the chicken (plucked and frozen) is stored in cooled freezer chests. These chests are not connected to the electricity mains but are instead filled with ice to keep the chicken cool.

## 4.5 Indirect Actors in the Poultry Value Chain

The poultry & eggs value chain is well developed in Senegal. A variety of indirect actors play (potentially) in its operations.

### 4.5.1 Veterinary Regulation

The quality of imported hatching eggs is managed by the Directorate of Veterinary Services (DVS). They issue the import permits for hatching eggs and are responsible for quality check on the eggs. They are also responsible to managing the veterinary services in Senegal, which includes control over vaccinations and disease outbreaks.

### 4.5.2 Equipment Supply

Typically, equipment is sourced directly from suppliers in the EU. Imports from France seem to be more established. Sourcing of second hand equipment seems fairly commonplace.

### 4.5.3 Professional Organisations

The Poultry professional association, IPAS, has made great inroads in to organizing the sector. It has participation from the largest poultry producer in Senegal, SEDIMA, who at present holds the position of general secretary. The association has 4 divisions- producer, Feed suppliers, hatcheries and service providers. Producers thereafter have 2 separate sub-divisions. 30 Large producers work together in one branch, with the balance of the producers working together in another.

They are active especially at lobbying and have been able to keep the regulatory authorities firmly supporting the import ban on uncooked chicken meat.

### 4.5.4 Banks and Microfinance Organisations

In recent years, the State has developed new initiatives aimed at improving access to finance through the establishment of structures such as the National Bank for Economic Development (BNDE) and the Priority Investment Guarantee Fund (FONGIP).

These were designed to increase access to financial products in general through the formal banking system. In theory producers in the poultry and egg sector are able to access finance through the larger banks such as the CNCAS<sup>14</sup>. The costs of administration, smaller footprint of these banks and the type of products they provide however generally makes these more suitable to large industrial or integrated producers.

<sup>14</sup> Caisse Nationale de Crédit Agricole du Sénégal

When it comes to small scale commercial producers, self-financing is the norm. They rely on credit from friends, family and personal networks. Where financing is sought from the formal banking sector, this tends to be from MFI's such as PARMECAS<sup>15</sup>, ACEP<sup>16</sup> and the Banque Mutualist, which have better coverage, more suitable products, lower administration fees and a greater capacity to screen lenders and collect repayments. The credit is suitable both for working capital and for smaller loans for capital investment such as for constructing sheds or purchasing feeding equipment etc. Typical loan values for small scale producers are 500 000 FCFA, which is issued for a 1-year period on working capital and 16% interest. Typical local values for capital investment in sheds, feed equipment etc., is 1mio FCFA, over a 3-year period and with 18% interest rates per year. These loans can be accessed by individuals or groups of producers.

#### 4.5.5 Agricultural Insurance in Senegal

Agricultural insurance been developed fairly recently in Senegal . The National Agricultural Insurance Company of Senegal (CNAAS) works closed with Banque Agricole and offers a variety of insurance products in all agricultural sectors with the exception of livestock and fishing. These products tend to cover the risk of crop failure due to flooding or (index insurance), to damage caused by birds, wildlife, etc.

The ambition of the fund is to extend coverage to all agricultural producers, especially when they access credit. This involves working with the formal banking system as well as MFI's, who have better coverage with small scale producers. Agricultural insurance is thus available to the poultry and egg producers, but they do not have access to government subsidies for their premiums.

Industrial producers generally take out insurance for the full value of their production. Small scale producers who do have insurance products tend to insure only the value of their inputs. Despite insurance being available in principle from CNAAS, MFI's working in the poultry sector didn't require agri-insurances for access to credit. Only life insurance was mandatory. In fact, they didn't offer agri-insurance products at all.

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<sup>15</sup> Partnership for Mobilizing Savings and Credit in Senegal (PAMECAS)

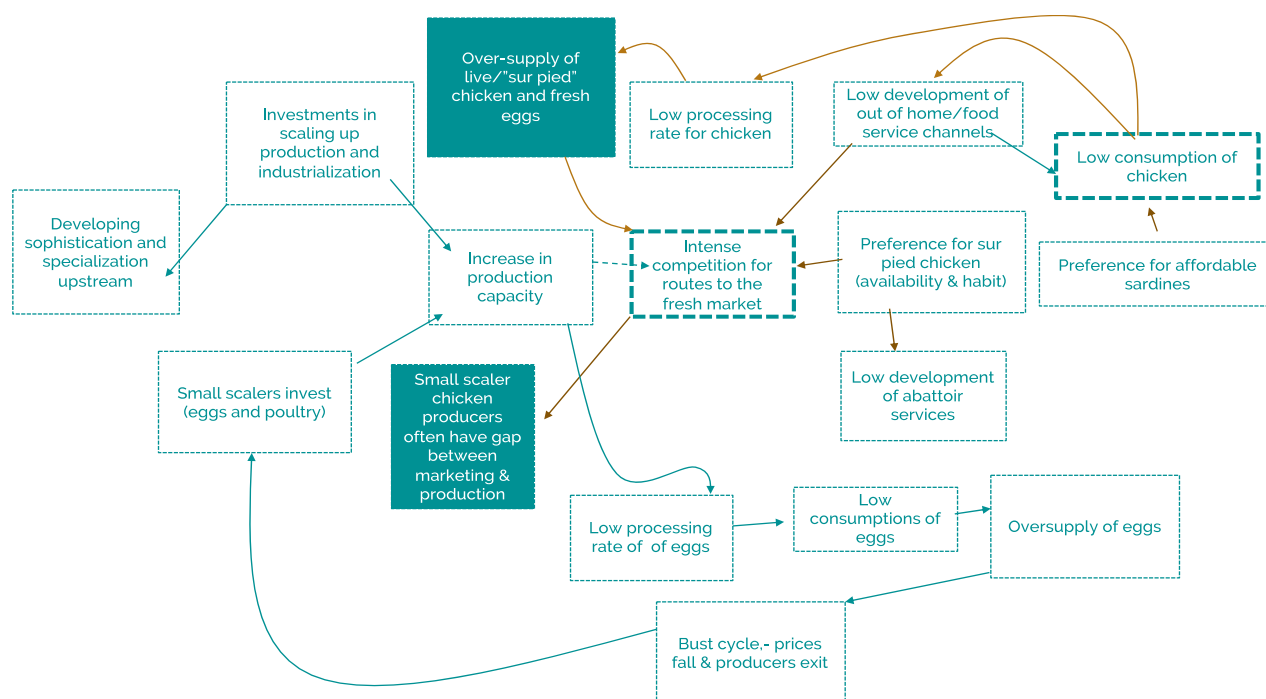
<sup>16</sup> Alliance of Credit and Savings for Production (ACEP)





## 5 Issues and Opportunities along the Value Chain

Figure 79 Critical Issues in the Poultry and Egg Chain



### 5.1 Low Market Development for Production Capacity

Over the last decade significant private sector investment has been instrumental in scaling up production in Senegal. There are far more commercial producers in the sector than even 5 years ago. Also, those in the sector have introduced more technology, their own slaughter lines and freezers that have enabled them to produce at a far larger scale.

Yet it seems that the growth and development of the demand end of the equation has not kept pace with production. Chicken is still consumed at home, largely with the family and only once a week. There seem to be some signs of the chilled chicken segment developing in Dakar. But outside of this top-end segment and the limited food services segment, most Senegalese continue to purchase live chicken, “sur pied” from markets and neighbours.

This stilted development in the demand side has a knock-on effect upstream. Firstly, slaughtered and frozen chicken are critical to producers being able to keep a strict control over the production cycle and the consequent feed conversion rates. Keeping chickens in production for just a few days after they have reached the end of the production cycle has a marked effect on the feed conversion rate.

Secondly, freezing or even chilling chicken has a smoothing effect on the market. When chicken production exceeds demand, the chicken can be frozen. And these volumes can be used when demand peaks- for example around festivities. Another key mechanism to smooth out demand is processing. When chicken surpluses, the chicken meat can be converted into new formats that are relevant at different meal occasions. Eating a whole chicken on the go, isn’t as convenient as a cold cut on a sandwich. And these different formats open up opportunities for variety and so greater consumption at and in the food services sector.

But these critical outlets for chicken have not developed in Senegal. As a result, large industrial producers face surpluses and uncertainty around marketing of chicken at various moments in the year.

A second affect is that it intensifies competition for markets in the fresh market. Large commercial producers tend to lock in traders, who are in turn only too happy to deal with a few large, reliable suppliers. Small commercial producers feel the pinch. At the end of their 45-day cycle many don't have ready buyers for their full production volumes. Extending the production cycle reduces the feed conversion rate. And as the space and working capital is needed to begin a new round, the gap between production cycles can be unexpectedly long. Generally, these producers plan for a 2-week gap between production cycles. But this can be longer.

### 5.2 Low Processing Rate for Eggs

Egg consumption in Senegal is likewise low when compared to the scale of commercial and informal production that is possible. In more developed markets egg consumption is increased by using eggs in processed products. Egg powder is found in formulations for baked goods and desserts, sauces, thickeners etc.

In more developed markets the processing segment provides a useful outlet for large volumes of eggs and helps to absorb surpluses. But this stabilising force is absent in Senegal. As a result, the market is prone to boom bust cycles. New entrants and scaling up creates surpluses in the fresh market. Many small scalers then "dump" their eggs aiming to minimise losses rather than being stuck with eggs that they can't sell. This creates a bust cycle with producers exiting commercial production. And then as volumes rebalance and prices stabilise, more investments get made in production of eggs, beginning the boom bust cycle anew. Stabilising the egg market hinges of developing a processing segment.

### 5.3 The Market Access Gap

Small scale producers typically have a 45-day growing cycle. At the end of the cycle they take their sheds out of rotation for 2 weeks for a planned cleaning period. During this period the producer is also marketing the chickens. If the chickens are sold quickly, then they are to clean the sheds as planned and begin a new production cycle. However, if it's difficult to find buyers, then the production cycle for the chickens is extended. This is especially true if the scale of production is on the smaller end of the scale. Traders tend to favour larger producers, who can fill all, or most of their order volumes.

The impact of this market access gap is threefold. Firstly, feed conversion ratios in small scale commercial units vary from just above the global benchmarks of 1.6 to 2. Secondly, without working capital to pre-finance the next cycle they reduce the total number of cycles possible per year from 8 to 6. The cost of the market access gap, even when a few days are scheduled in for cleaning, is thus high. Farmers lose 25% of the potential revenue from this issue alone, before we've included the cost of feed.



At the end of the life cycle broilers consume about 100 g per day of feed. At the current costs of finisher each additional day costs 24.80 FCFA per bird. With flock sizes of 2000 birds this is a substantial reduction in potential income.

Figure 80 Costs Associated With Delay in Sales of Mature Chicken

	Market Access &/or working capital	Market Access Gap with no working capital
	45-day cycle	45-day cycle + 2-week marketing period
# of cycles per year	8	6
Cost of feed per bird each additional day		24.80 FCFA per day (based on 100g per day)

#### 5.4 Access To Finance for Small Scale Producers

The Formal Banking sector has an interest in extending credit to poultry producers. However, they have struggled to develop products that have a good fit with small scale producers. In general, administrative fees are seen as being too high for these products to be relevant.

Financing products are available to small scale producers largely via micro finance institutions, who have a good footprint in rural areas in Senegal. However, in general, Senegalese farmers are unaware of available financing products. They also have a tendency to rely on private financing from friends, neighbours and family rather than the formal lending. A recent study suggested that only 3% of Senegalese get credit from the formal sector.

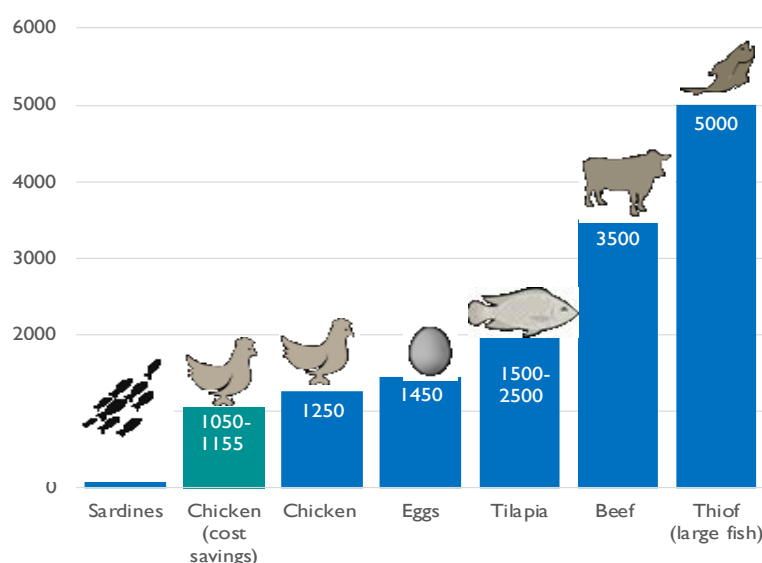
This is true of the poultry sector too. Most small scaler farmers self-finance production or turn to personal networks to secure working capital or capital to expand. This gap in awareness of financing and its associated costs versus benefits has resulted in a low uptake rate of available financing products. This limits the potential of farmers to expand production, either through increasing the number of production cycles per year, or the size of the flock per cycle, which is important to get traders interested.

The risks associated with the rainy season, both in terms of disease pressure and price volatility, means that some MFI's are more careful with the loans they offer for production during this specific time of the year.

#### 5.5 Affordability

The affordability of chicken has been highlighted as being an important barrier to more frequent purchase amongst Senegalese shoppers. Reducing sales prices and production costs are thus an important ingredient for growing demand for chicken. Local production of hatching eggs, which is currently done only by Sedima, provides at least a 190 FCFA-400 FCFA cost saving per chicken bought. It brings chicken to being just over twice as expensive as sardines per kg and ensures that it's very competitively priced when compared to Tilapia (per kg). What seems like a modest cost saving could have widespread benefits for the sector.

Figure 81 Price Per Kg of Selected Meat Protein in Senegal



As companies invest in hatching egg production, it will become more important to ensure that the genetics are good and that growth rates remain high. There are some concerns that the growth rates of chickens from local hatching eggs from Sedima are slower when compared to those from expensive imported hatching eggs. This would need to be verified, especially as the feed conversion rates amongst farmers in the Sedima system seem to be in line with global benchmarks. Nevertheless, to see continued benefit it's important that these local hatching egg producers remain up to date with the latest

techniques, invest in renewing genetics and continuous improvement at their facilities.

### 5.6 Small Scalars Not Producing in the Wet Season

Production in the rainy season tends to taper off in Senegal. The wet, hot conditions tend to increase the disease pressure and are not ideal conditions for chicken growth or laying off eggs. Typically, this would be solved by investing in climate-controlled sheds. Yet in Senegal many producers have expressed scepticism in the affordability of climate-controlled sheds with less than 10 000 birds per cycle. Without suitable small-scale technology, farmers are left having to cope with a fewer production cycles.

### 5.7 Disease Prevention

The sector has been fairly good at managing disease. This is in part due to the high use of vaccinations and good access to veterinary products and skilled personnel. Nevertheless, growing chicken production, especially in intensive models of product, requires that the sector remains focussed on disease prevention as well as in developing early warning systems for small scale farmers.

Firstly, this requires a firm focus on the production methods that are being used. Secondly, it requires support of the veterinary services, which include DVS so that these services and products remain available and used. Finally, small scale farmers around the world are typically last to hear about disease outbreaks and have the lowest skill levels to deal with outbreaks. Ensuring that they have early warning systems and sufficient training to be able to prevent and respond to outbreaks could be an important protection for the sector.

### 5.8 Regional Competitiveness

Poultry production in Senegal is particularly more developed than in much of the region. The quality and price of inputs seems to be comparable if not better. Thanks to the Port of Dakar and

production relatively close to the city, feed costs should at least in theory be better than elsewhere in the region. Finally, the presence of industrial integrated producers and their organising effect on the sector is a real advantage. They have brought in the right technology and agricultural practices and have created scale in the market to be able to support quality veterinary services. As a result, Senegal has the potential to become a competitive regional producer.

### 5.9 The Missing Commercial Middle Hypothesis

Commercial sector development in Senegal seems to be following trends in both developing market and to some extent in the EU. There seems to increasingly be 2 modes of commercial production- small scale production, or large industrial production. But why is this the case?

This can potentially be answered by examining the impact of scale on market access and costs. At 2000 birds per cycle, farmers are still able to access markets relatively well. If they have over-runs of a few days, the costs are manageable. However, scaling up has a few implications. At a larger scale, it becomes very important to have a system to reliably supply traders all year around and then to mop up over-supply. This requires a shift to cooled sheds and frozen chicken. Yet, local producers suggest that the scale required to make this feasible is over 10 000 chickens for broilers. Being able to gradually grow in scale seems very challenging- especially with the additional risks around market access, volatility and the risk of producing in open air sheds without climate control.

## 6 Environmental Sustainability (Circular Economy)

On a macro level developing a local industry holds significant environmental benefits. It allows for Senegal to produce food close to where it's produced. For the chicken and egg sector this is negatively affected by the reliance on imported grain for feed.

From the perspective of circular economy, the sector performs quite well. In the case of large industrial producers' waste at their processing facilities are sold as pig feed. Across the chain animal excrement is sold to the fertiliser chain. Thus, waste in the chain is quite low. Feed conversion rates are fairly efficient and the "just in time" production system ensures that waste is minimised in the sales and distribution system.

There are potentially some emerging, yet still relatively minor issues, around energy and animal welfare. The more developed segment of the sector- i.e. industrial producers have made a shift from the low energy system of the "just in time model" to the more energy frozen or chilled chicken. Managing energy consumption tightly is thus something to watch and manage. It will also become more important if the sector makes a shift to more chilled or frozen chicken sales.

Animal welfare is another small emerging theme amongst shoppers. Many were concerned about the environmental conditions in which the chickens are grown. This was less for the benefit to the welfare of the chickens but rather for the impact on the quality of the meat. This concern could be partly caused by disease outbreaks in the early 2000s. Diseases in the poultry sector have been relatively well managed. Nevertheless, it would be beneficial to take some preventative action in the poultry sector to ensure that safe farming techniques are used; veterinary services remain available and by ensuring that there are some early warning systems built in so that small scalars are aware of outbreaks and are able to react before it's too late.



## 7 Socio-Economic Development (Food Security, Employment, Women and Youth)

The poultry sector is estimated to be a 130 billion FCFA business (17% of livestock GDP). More than 500 000 people are employed in direct and indirect jobs. This alone would make it an important activity to safeguard. Yet the chain has an equally, if not more important role to play in food security.

Declining fish stocks and overfishing in Mauritania for fish meal production threaten the supply of sardines and larger fish varieties, which are a key part of the Senegalese diet. Chicken and eggs are the next most affordable animal protein source. By ensuring that this sector is robust, and chicken becomes more affordable you provide some degree of self-sufficiency and resilience in protein production.

The poultry sector also provides opportunities for better inclusion of women in commercial activities. Women are traditionally involved in informal chicken production. Commercial chicken production thus has a good fit with the traditional activities of women. Small scale commercial production also has low barriers to entry. The good organisation of input supply means that they are able to relatively easily access quality inputs. Poultry and egg production can be done relatively intensively, the staff requirements are low, and it demands comparably small areas of land for production. These small plots of land can easily be rented.

On the other hand, we need to recognise that access to finance is one of the major challenges facing women wanting to begin commercial chicken production. Household savings are typically used to finance the activities of men in the household. One advantage that women have in this sector is that they are favoured by MFI's involved in extending loans in the sector. They recognise that women are often more reliable repayers, especially when they are organised in to women's cooperatives. So, access to finance could be possible, but women need to be organised and made aware of the opportunities.

## 8 Options for Intervention

### 8.1 SWOT Analysis

The following SWOT analysis provides a summary of strengths, weaknesses, opportunities and threats:

#### Strengths:

- Continued industrialization and investment has created a dynamic and efficient sector
- High quality imported inputs delivering world class feed conversion rates
- Market protections prohibiting the import of chicken meat or live chickens
- Good veterinary controls, high use of veterinary products and vaccinations and skilled veterinary staff

#### Weaknesses:

- Low market development versus production capacity (low consumption rates of chicken and eggs, low development of out of home consumption, undeveloped processing)
- Preference for sur pied chicken over frozen, which creates a "just in time" market dynamic
- Small commercial producers have fluctuating food conversion rates



- Competitive input supply especially day-old chicks
- Low waste, which generally gets converted into fertilisers and pig feed

because of poor linkages to traders at the critical 45-day mark

- Production stoppages for small scale producers in the rainy season with sharp declines in prices at the start of the season
- Falling demand in the Tabaski period
- Unclear how small scalers can make a gradual transition to larger scales of production (a missing middle).

#### Opportunities:

- Projected Urbanisation that should increase demand for animal protein
- Declining fish stocks will encourage shoppers to look for affordable alternatives
- Good fit with the traditional activities of women and youth, with low barriers for their entry

#### Threats:

- Borders remain closed to imports. Without these protections there is a risk that local producers may not be able to compete

## 8.2 Interventions (SDG Goals and Impact, Dutch Transfers)

There are a few areas along the value chain that could benefit from intervention. Supporting small scale producers to improve their farming skills and ensuring that the veterinary systems remain strong would help to ensure that production is safe and disease free. There are also opportunities to increase participation of women in the commercial poultry production through training and access to finance.

Yet these interventions would not address the fundamental challenge of the sector: the lack of market development. Industrial producers have made investments to increase their scale of production and improve efficiencies. But this has outpaced the growth in demand, has come without the development of a processing sector and very slow development of frozen chicken segment which typically helps to absorb over-supply and ensures continuity of supply during demand peaks. This has created a severe logjam in the development of the chain. Industrial producers and small-scale commercial farms are all competing for the same market- live chicken- and market distribution systems (bana banas). Without the technology being used by industrial producers, the producers in the middle can't compete. Small scale producers are forced to hold chicken for longer than then 45 day cycle, which is not a competitive production model.

Tackling this fundamental question of market development is critical to being able to transform the sector to one that is more sustainable and is ready to compensate for declines in sardine production. But for this to happen, many questions will need to be answered. Is there a local market for frozen and processed chicken? If so, what infrastructural changes are required to make the shift from live chicken consumed at home, to a frozen chicken market with a stronger food services sector? Can the advantage of industrialised chicken production enable Senegal to become a regional production centre? Are there opportunities to process chicken eggs? And if so, which products should be produced for which markets?

Getting to grips with these questions will provide some roadmap for development of the sector. It's a core ingredient for large industrial producers to be able to tackle the current demand ceiling and to ensuring that the sector becomes more sustainable.

### 8.3 Overview of Proposed Interventions

Bottlenecks	#	Interventions	Fit with Dutch Knowledge, Strategic interests etc.	SDG Goals
Poor market development of chicken & eggs creating a ceiling on the growth of production.	1	Explore market development mechanisms especially the market opportunities for frozen chicken, processed chicken, processed eggs (especially egg powder).	***	8
Market access for small scale farmers who are pushed to hold live chickens beyond the 45-day cycle.	2a	Explore mechanisms to include small scale farmers in a new frozen or processed chicken opportunities.	**	1,2,5
	2b	Support activities that increase access to finance, especially for working & investment capital for women.	**	
Expand local hatching egg production to enhance affordability of chicken.	3	Increase capacity of local hatching egg production. This includes increasing the quantity and quality of chicks produced.	****	8
Ensure good farming practices, support of veterinary services and early warning systems to keep tight control of diseases.	4a	Reinforce the good practices around disease control by expanding training of small-scale commercial producers, strengthening of veterinary services knowledge and skills. Develop early warning systems for disease outbreaks in the poultry sector including pro-active interventions around health and safety.	****	1, 2, 4, 5
	4b	Support small scale farmers with continued education (farming techniques and financial literacy) to ensure continued competitive and safe production.	***	
	4c	Develop early warning systems for small scale producers around disease outbreaks.	**	
Opportunities for women and youth produce eggs	5	Support women by investing in skills development and access to finance.	***	4, 5



and chicken (provided that local market development is occurring).

Sustainable Development Goals



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