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Senegal Value Chain Study - Onions

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SENSE

Senegal Value Chain Study - Onions

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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.

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 louma, 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

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

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

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 triplication. 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.

Table of Contents

1 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.

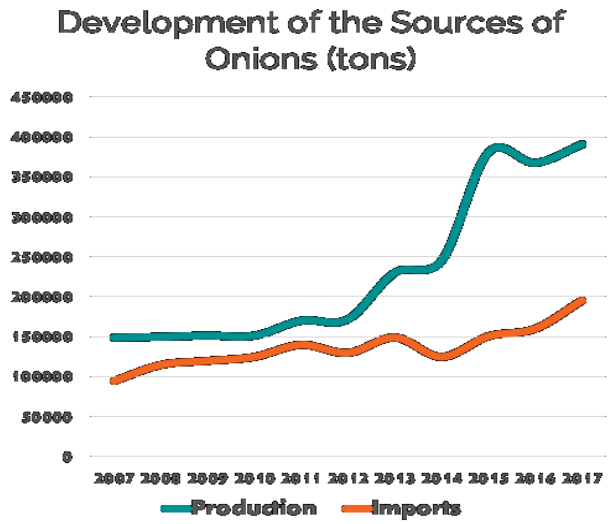
2 The Market

2.1 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.

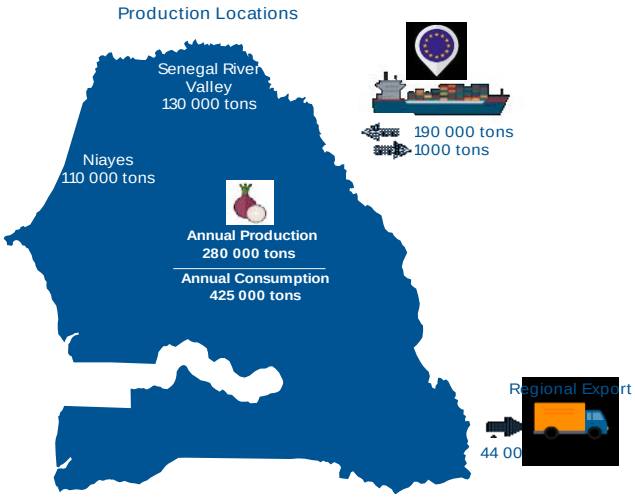
Figure 1: Import and Production of Onions in Senegal



Origin of imported Onions (tons, 2019)

	Volume (tons, 2019)
Netherlands	128 000
China	20 500
Belgium	2 700
Other	13 000
Total	164 000

Figure 2 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.

2.2 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.

2.3 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.

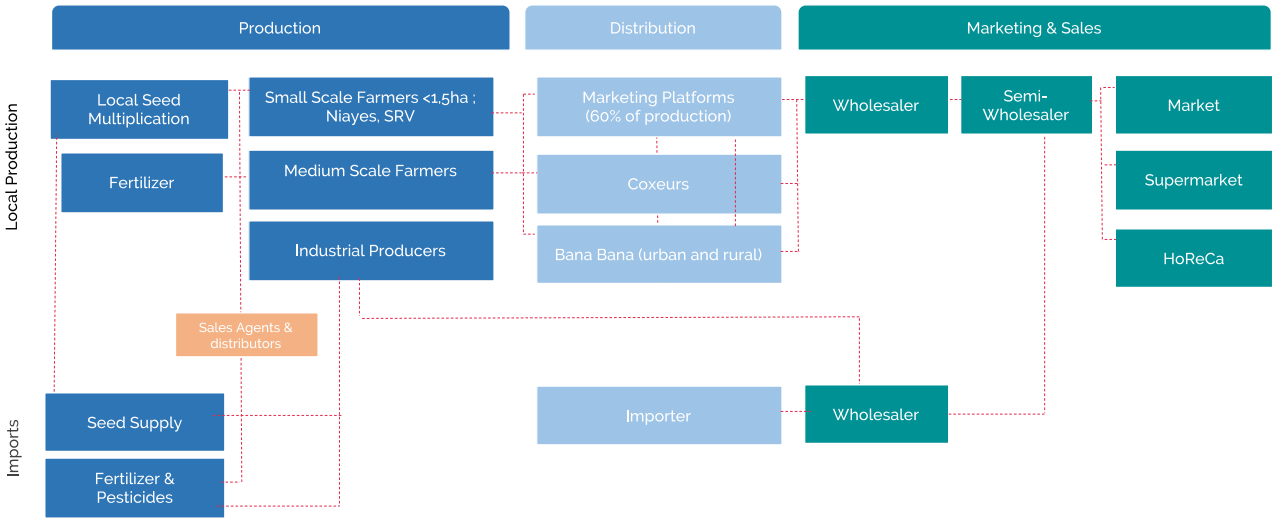
Figure 3 Onion Imports for Ivory Coast in 2018 by Source (ITC Trade Map)

	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

3 The Structure of the Value Chain

3.1 Overview

Figure 4 Map of the Value Chain



3.2 Production

3.2.1 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.

3.2.2 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.

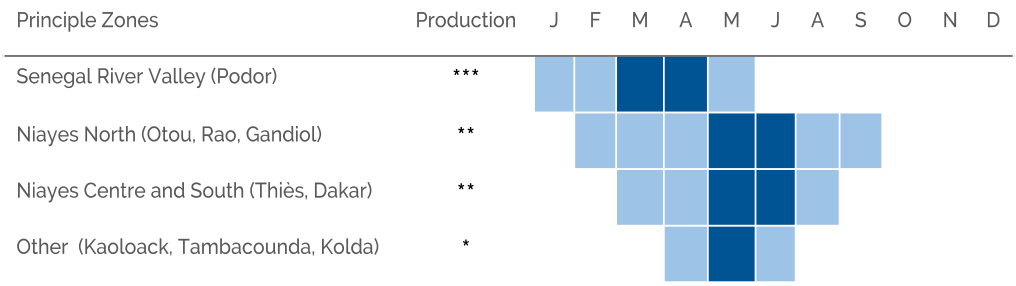
Then, later in the year, temperatures in this region rise to 40°C in the wetter May-October months. The dominant onion variety, the Violet de Galmi, is by nature relatively heat tolerant variety. However, these temperatures are simply too high for it to withstand. From May onwards high temperatures, 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.

3.2.3 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 5: 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.

3.2.4 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[1] 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.

[1] This is not all under cultivation

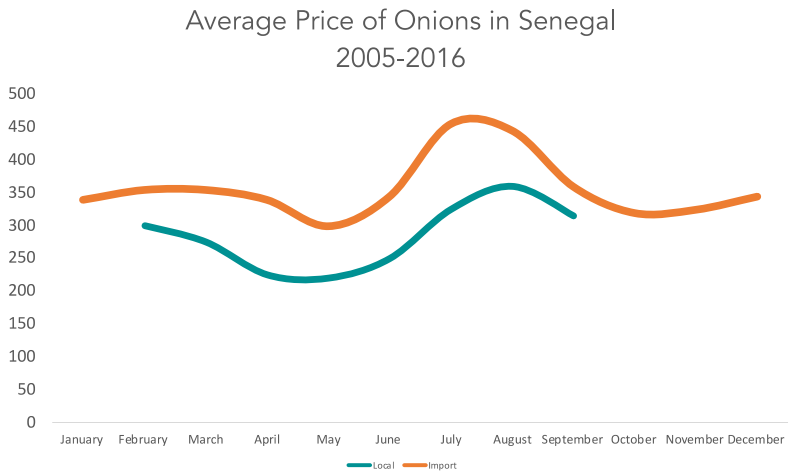
These are not the first preference of most local producers or shoppers and are not very storable. Another area where they are different from small scalers is their openness to a wider "product mix" and end customer. These producers also grow white onion varieties, that are able to deliver 5x the yields 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.

3.3 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 6: Onion Prices Throughout the Year



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

3.4 Input Supply

3.4.1 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.

3.4.2 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.

3.4.3 Varieties

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

Figure 7 Overview of Dominant Onion Seed Varieties

	Cold Season Crops			Hot Season Crops
	Early Crops (hasty)	Full Season Crops	Medium-Late Season Crops	Late Crops
	Sowing Dates			
Variety	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				*

3.4.4 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.

3.4.5 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 subsided 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[2].

Figure 8 Comparison of Cost of Various Fertilizers Available to Farmers

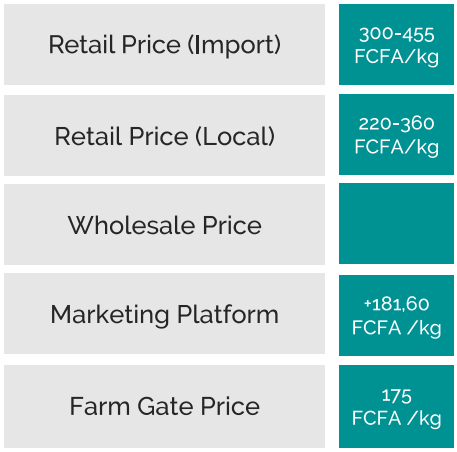
NPK (10kg bag)	DAP (10kg bag)	Poultry (50kg bag)	Animal Livestock (50kg bag)	Compost (Casuarina tree) per wagon
1200	1400	1750	650	2000

3.5 Route to Market

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

[2] Animal manure fertilisers are applied in different quantities per hectare to industrially prepared fertilisers

Figure 9: Prices Along the Value Chain



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.

3.5.1 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.

3.5.2 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.

3.5.3 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 10: 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

3.5.4 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.

3.5.5 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.

3.5.6 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.

3.6 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.

3.6.1 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.

3.6.2 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)

3.6.3 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).

3.6.4 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.

3.6.5 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.

3.6.6 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.

3.6.7 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.

3.6.8 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.

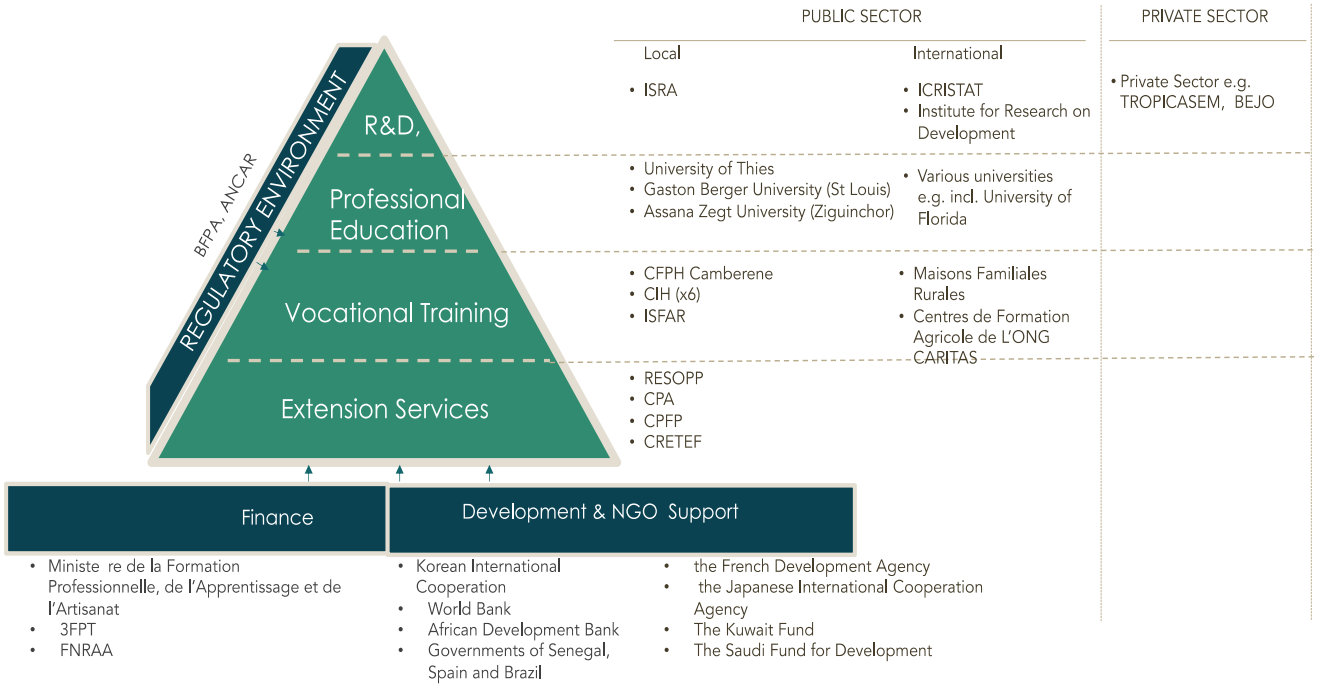
SAED are very active in onion extension services in the Podor region and are a key stakeholder in implementing projects in this critical onion growing region.

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 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 11 Overview of Knowledge and Skills Development Actors in Senegal[3]



3.6.9 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.

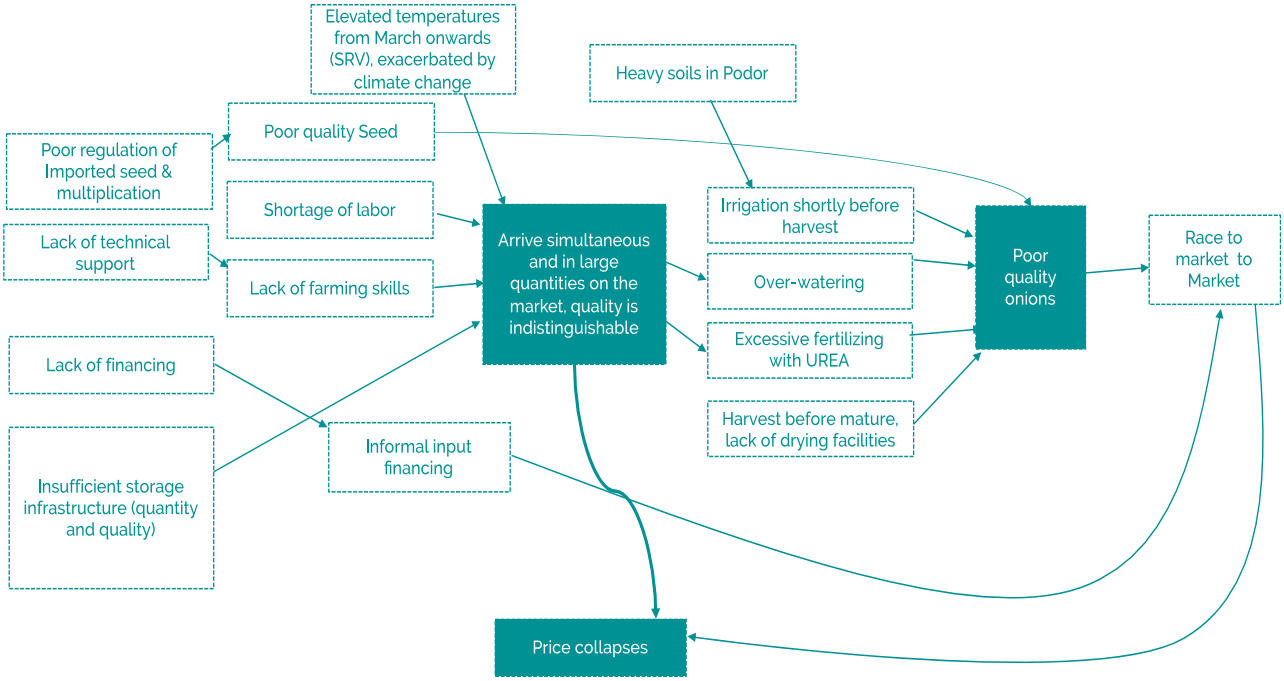
4 Issues and Opportunities along the Value Chain

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

Figure 12: Overview of issues and Opportunities in the Value Chain[4]

[3] 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

[4] Inspired by and partially sourced from Hélène David-Benz et Abdoulaye Seck. Améliorer la qualité de l'oignon au Sénégal Contractualisation et autres mesures transversales; FAO; 2018



4.1 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.

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.

4.2 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.

4.3 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.

4.4 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.

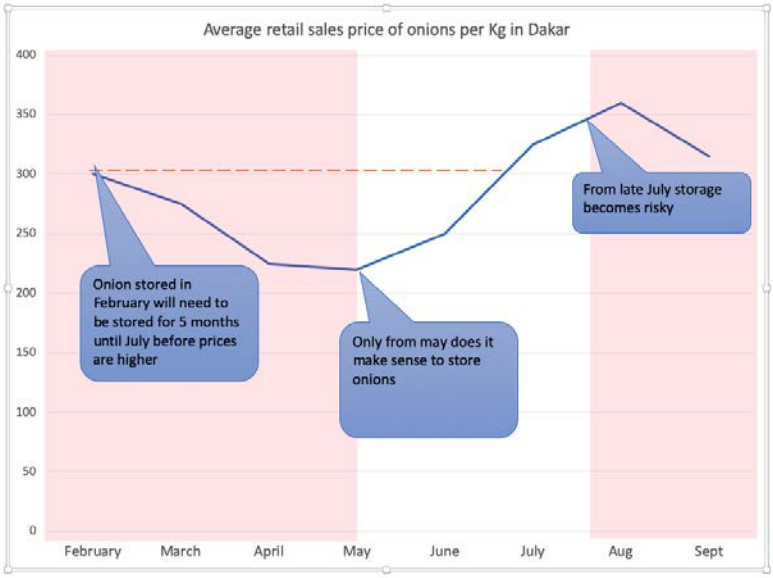
Some would argue that storage is poorly distributed: the Niayes has significantly more storage than the lead production area in the Senegal River Valley, Podor, which has only two stores, of 5 tons and 50 tons. Meanwhile Potou in Niayes has two 50 tons stores. However, as we will explain in the next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

4.5 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 13: 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 14 Profitability of Late Season Onion Storage in the Niayes

	Onions												
	Purchase		Sale		Storage duration	Gross margin	Onion quality	Storage Loss		Storage type	Storage cost	Financial cost	Profit	
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.

4.6 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.

4.7 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.

4.8 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.

4.9 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.

4.10 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.

4.11 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.

4.12 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.

5 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 scalers 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 scalers 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.

6 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.

6.1 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.

6.2 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.

6.2.1 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.

6.2.2 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).

7 Options for Intervention

7.1 SWOT Analysis

The following SWOT analysis resumes the foregoing issues:

Strengths:

- Market protections (import freezes for most of the year, quotas and tariffs)
- Expanding production along the Senegal River Valley and new areas
- Investment from Industrial producers
- Privatised seed and input markets

Weaknesses:

- Volatile pricing that encourages speed to market over quality
- Cheating in the inputs market
- Unreliable seed quality (poor regulatory control)
- Distortionary effect of fertiliser subsidies on input marketing and sales
- Relatively low yields (17-24tons per ha)
- High waste due to unreliable inputs & poor farming and harvesting techniques
- Reliance on migrant labour at harvest & labour for manual irrigation (especially in Niayes)
- Heavy soils encouraging irrigation close to harvest along the Senegal River Valley

	– Risk carried by farmers – Under-utilized storage; insufficient capacity, quality and poor distribution
Opportunities: – Mid-tier; mid quality onions for local markets – Regional export opportunity in the peak production season, especially to the Ivory Coast – Space for women and youth in seed multiplication and agri-service development (mechanization, irrigation, storage)	Threats: – Unsustainable agricultural practices- water management, land management, soil fertility – Risks from climate change, increased salinisation – Pressure on groundwater suppliers that feed Dakar

7.2 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.

7.3 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 Cheating in the fertilizer and pesticides markets, low skills and knowledge base of distributors	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
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

Table of Contents

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