



## Business Case: Multi-Crop Vegetable Farm With Off-Season Fodder Production





## Description of Business Model

The business model is developed for a commercial vegetable farm that rotates open field vegetable crops during the main production season (October to March). This is done under 3 pivot irrigation systems in order to avoid build up of crop specific pests such as nematodes. Each field only has the same crop every third year.

The vegetables chosen for this model are onions, potatoes and cabbages because they do not share the same pathogens and are therefore good rotations. These vegetables are in strong demand on local and regional market. However, the choice of vegetables to be grown would be made by the entrepreneur and may vary according to their perception of the market outlook.

The model would also function for a farm growing vegetables for the European counter season vegetable market, although the choice of crops would be decided by demand from the importer.

In this model, sorghum is grown during the off season (April to September) as a fodder crop for sale to livestock farmers, and to be reincorporated as green manure to enrich the sandy soils of northern Senegal. The variety of sorghum chosen for this model can be cut 3 times during the season if farmed under irrigation. The first 2 cuts are dried and sold in bales to livestock farmers. The third cut is reincorporated into the soil as green manure.

In addition, growing fodder during the off season prevents salinization of the soil which happens when irrigated land dries out and salt precipitates on the surface through capillary action.

Fodder also provides additional cashflow to pay off the substantial investment in irrigation infrastructure and has impact on local communities through the circular economy.



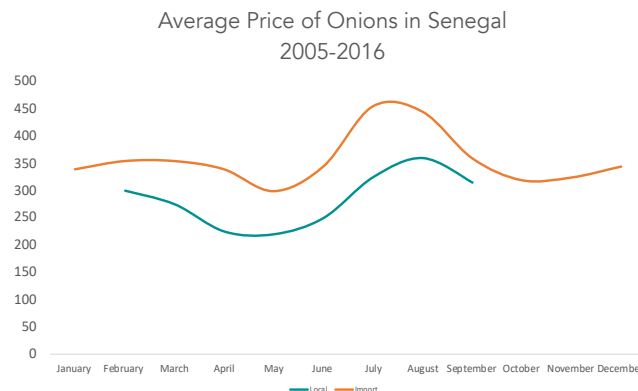
## Typical Entrepreneur

- A. Existing large-scale local market vegetable producers who needs to rotate crops, reducing disease pressure and maximizing land use
- B. EU Importers looking for supply of vegetables outside the European production season.



### Market

- There's a growing demand for high quality onions and potatoes on the local and regional market. Potatoes from commercial farms are stored and marketed in June, a legal requirement, so as not to compete with supply from small-scale farmers whose production arrives on the market from March to May.
- Cabbages are an easy to grow rotation that performs well on the local market and does not require any additional specialised equipment.
- Regional opportunities exist to export onions and potatoes, but this market is dependant on high quality product that can be stored and transported.
- The willingness of local shoppers to pay premium prices for imported onions throughout the year suggests that there is an opportunity for local improved quality, mid-tier priced onions.



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

### Ivory Coast Onion imports by origin during the peak production season in Senegal

	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

Source : ITC Trade Map

### Product or Service

**A wide variety of local market vegetables can be produced in this model. We have chosen onions, potato and cabbage because of high profitability and demand.**

**Onions:** High yielding varieties (Mercedes or Red King) of onions from imported seed.

Average yield 50 to 100 tons/ha. Sales Price: 220 FCFA/kg.

**Potatoes:** Produced from imported early generation and disease-free seed potatoes can be harvested in March and sold in June. Sales price rises for FCFA 180-300/kg between March and June.

**Cabbages:** Variety is dependent on local growing conditions and market preferences: Farm gate price estimated at FCFA 160 per cabbage.

**Fodder:** 3-cut per season variety sells at FCFA 75/kg or FCFA 1875 per 25 kg bale.

### Rationale for investment

#### Local and regional market Onions

- The regional market for onions can only be accessed by high quality onions which can survive transport. Markets include Mali and Mauritania, although market prices are lower than Senegal. The Ivory Coast presents an interesting market, for surplus onions that cannot be sold domestically.

#### Late season potatoes (premium prices)

- Industrial potato farmers are required by law to market their product after small-scalers are out of the market so as not to offer unfair competition. This has the advantage that the price rises from FCFA 180 at harvest in March to FCFA 300 in June.

#### Local market cabbages

- Cabbages are in high demand, out-performing most other vegetables.
- They are easy to grow and sell, requiring no specialized equipment.
- Traders buy cabbages at the farm gate, saving transport and marketing cost.

#### Fodder crops (Circular Economy)

- Senegal is a nation of livestock farmers whose primary difficulty is access to adequate fodder for their animals. Historically this has led to desertification through overgrazing.
- Manure is purchased from livestock farmers.



### Key Assumptions

YEAR 1	October - March	April - September
Pivot 1 (90ha)	Potato	Sorghum (270ha)
Pivot 2 (90ha)	Onions	
Pivot 3 (90ha)	Cabbage	
YEAR 2	October - March	April - September
Pivot 1	Cabbage	Sorghum (270ha)
Pivot 2	Potato	
Pivot 3	Onion	
YEAR 3	October - March	April - September
Pivot 1	Onion	Sorghum (270ha)
Pivot 2	Cabbage	
Pivot 3	Potato	

### The Rotation

- The farm has 3 centre pivots of 90 ha close to Lac de Guiers or the Senegal River in a cooler micro climate suitable for potato production in the winter months
- Most crops, especially potato should not be grown on the same plot year after year due to accumulation of disease pressure (nematodes) and depletion of the specific nutrients required by that crop.
- From April to September it is too hot for vegetable production. To avoid soil drying out & resulting in salinisation, a fodder crop is produced ensuring irrigation all year round.
- The sorghum yields 3 cuts, the third cut is reincorporated in the soil as green manure. This improves fertility and soil structure for crop farming.
- The 3 pivot system maximises land usage and return on the investment in irrigation.

#### Sorgho Géant Santa Élise

The fodder crop chosen for this rotation is a forage sorghum that can be cut 3 times over a 90 day cycle yielding up to 170 tons of green matter per ha (45 tons dry). The first 2 cuts are dried, yielding 30 tons per ha/year of hay for sale. The third cut of 50 tons is cut and left in the field. When land is prepared for the following rotation crop, this is reincorporated into the soil.



### Potatoes

- Potato yields in Senegal average 30 tons/ha.
- The model makes use of large doses of Nematicides as is the current practice. However, with a good rotation, it may be possible to reduce pesticide use.
- Potatoes are harvested in March, but are kept in diffused light storage until June.
- Prices rise from FCFA180 in March to FCFA 300 in June when all of the small-scale producers have exited the market

### Sorghum

- Traditional Sorghum has a short season and with 100-200mm of precipitation can yield 15 tons per ha. However, Brazilian varieties available in Senegal can be farmed under irrigation and yield 3 harvests of 15 tons.
- The first 2 are harvested before seeds mature to avoid self seeding in the vegetable season.
- The third harvest is cut before flowering and reincorporated as green manure to enrich the sandy soils of northern Senegal.

### Red King Onions

- Yields of Red King onions are between 50 and 100 tons/ha. We have used a conservative 60 tons/ha.
- Good production techniques and post harvest handling We have used a farm gate price of FCFA 200.
- Onions are harvested in March and sold immediately as prices are in decline from March to May.

### Location: Lac de Guiers (Northern Senegal)

- This area has a cooler micro-climate allowing for potato production in the winter months from October to March.
- The area also has access to perennial water from the Senegal River.

### Cabbages

- Cabbages are planted at 30 000 head per ha.
- Cabbages are sold from the farm at FCFA 160 per kg.
- The cabbage production cycle is 3 months.
- They can be harvested from January and harvested to order for up to a month.

### Single Vegetable Rotation

- High temperatures & increasing humidity along the Senegal River Valley from February onwards are not conducive to vegetable growing.
- This model would be for a single season in the north of Senegal, with fodder crops as a rotation in the wet season.





# Business Case- Multi Crop Vegetable Farm With Fodder Rotation

## Economic Logic

### Production Costs & Gross Margins

	Cost per ha (FCFA)	Revenue per ha (FCFA)	Gross Margin
Onions	1 919 940	12 000 000	84%
Potatoes	4 882 292	9 000 000	45,8%
Cabbages	1 870 424	4 800 000	61%
Sorghum	987 201	2 250 000	56,1%

- With yields of 60 tons per ha onions are the most profitable crop.
- Potato has the highest cost of production due to the cost of seed FCFA 1 360 000 per ha.
- Potato is only profitable due to the ability to store potatoes until the price peaks in June. It is doubtful that small-scale production with lower yields and marketing at the low price in March is profitable.
- Energy cost of irrigation per ha for each crop is FCFA 550 000 @ FCFA 44 per M3.
- Irrigation is the major production cost after potato seed.

### Investment Required

investments	
Dry facility & packhouse	FCFA 200 000 000
Shed and offices	FCFA 600 000 000
3 Centre Pivots 90ha	FCFA 652 782 168
Implements and equipment	FCFA 46 403 333
Vehicles (incl. tractors)	FCFA 60 600 000
<b>Total Investments FCFA 1 019 785 501</b>	

### Return on Investment

Cumulative net income reaches FCFA 1 165 483 095 in month 9 of the 1<sup>st</sup> year.

### Available Financial Instruments

- Micro finance loans to individual farmers
- Commercial bank loans to the company for aggregation of onions at harvest.



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Year	1	2	3	4	5	6
<b>Revenues</b>						
Potato	810 000 000	810 000 000	810 000 000	810 000 000	810 000 000	810 000 000
Red King Onion	1 080 000 000	1 080 000 000	1 080 000 000	1 080 000 000	1 080 000 000	1 080 000 000
Cabbage	432 000 000	432 000 000	432 000 000	432 000 000	432 000 000	432 000 000
3 Cut Sorghum	607 500 000	607 500 000	607 500 000	607 500 000	607 500 000	607 500 000
<b>Total revenues</b>	<b>2 929 500 000</b>	<b>2 929 500 000</b>	<b>2 929 500 000</b>	<b>2 929 500 000</b>	<b>2 929 500 000</b>	<b>2 929 500 000</b>
<b>Variable costs</b>						
Potato	439 406 280	439 406 280	439 406 280	439 406 280	439 406 280	439 406 280
Red King Onion	172 794 600	172 794 600	172 794 600	172 794 600	172 794 600	172 794 600
Cabbage	168 338 160	168 338 160	168 338 160	168 338 160	168 338 160	168 338 160
3 Cut Sorghum	266 544 309	266 544 309	266 544 309	266 544 309	266 544 309	266 544 309
<b>Total variable costs</b>	<b>1 047 083 349</b>	<b>1 047 083 349</b>	<b>1 047 083 349</b>	<b>1 047 083 349</b>	<b>1 047 083 349</b>	<b>1 047 083 349</b>
<b>Gross margin</b>	<b>1 882 416 651</b>	<b>1 882 416 651</b>	<b>1 882 416 651</b>	<b>1 882 416 651</b>	<b>1 882 416 651</b>	<b>1 882 416 651</b>
<b>Fixed costs</b>						
Maintenance and insurance	90 120 027	93 184 985	93 184 985	93 184 985	93 184 985	93 184 985
Fixed staff	87 600 000	87 600 000	87 600 000	72 000 001	87 600 000	87 600 000
Other fixed costs	122 230 000	122 230 000	122 230 000	122 230 000	122 230 000	122 230 000
Depreciation	112 937 300	116 244 383	116 244 383	116 244 383	116 244 383	116 244 383
Long term loan interest expenses	103 673 220	74 210 468	27 720 101	-	-	-
Seasonal loan interest expenses	7 671 740	-	-	-	-	-
<b>Total fixed costs</b>	<b>524 232 286</b>	<b>493 469 837</b>	<b>446 979 470</b>	<b>403 659 369</b>	<b>419 259 368</b>	<b>419 259 368</b>
<b>Profit before tax</b>	<b>1 358 184 365</b>	<b>1 388 946 815</b>	<b>1 435 437 182</b>	<b>1 478 757 282</b>	<b>1 463 157 283</b>	<b>1 463 157 283</b>
Applicable tax	-	-	-	-	-	-
<b>Net income</b>	<b>1 358 184 365</b>	<b>1 388 946 815</b>	<b>1 435 437 182</b>	<b>1 478 757 282</b>	<b>1 463 157 283</b>	<b>1 463 157 283</b>
<b>Cumulative net income</b>	<b>1 358 184 365</b>	<b>2 747 131 180</b>	<b>4 182 568 361</b>	<b>5 661 325 643</b>	<b>7 124 482 926</b>	<b>8 587 640 209</b>



1

### Access to land in Lac de Guiers

- Lac de Guiers has a slightly cooler micro-climate that makes it possible to produce potatoes, cabbages and other vegetable crops during the cooler months from October to March.
- Availability of water from the Senegal River is a pre-requisite for crop production
- Land is available, although increasingly contested between crop farmers and herdsman.
- This issue is mitigated by the production of fodder for sale to livestock farmers



2

### The right crop rotation

- There are many vegetable crops that can be produced in Senegal between October and March.
- Some of these may be destined for the EU counter season and produced under contract
- A strong local market for high quality vegetables also remains under-supplied
- A rotation of crops that do not host the same pathogens is essential to avoid build up of nematodes and other crop specific diseases.
- Vegetables have the advantage of a short cycle, meaning the choice of crop can be made year on year, depending on the market outlook for the following season
- **The entrepreneur would bare all of these considerations in mind when deciding what to plant.**
- We chose local and regional market cabbages, potatoes and onions because of high demand, profitability and proven performance in the Senegal River Valley.
- Fodder is produced in the off-season to improve soil, avoid salinization and for sale to livestock farmers whose main difficulty is accessing fodder for their herds.
- This reduces the risk of clashes between crop farmers and herdsman.



3

### High performing seed varieties

- Vegetable production under irrigation requires substantial investment
- These investments permit high yields but also require these yields to provide a return on investment and irrigation costs
- Therefore, use of high yielding varieties that are well accepted by the market is essential



4

### Post harvest facilities

- Potatoes and onions both require specialized facilities for drying and post harvest handling to ensure that they have good shelf life and can be stored until the market price peaks.
- Good post harvest handling also allows produce to be transported, accessing regional markets.





### Community Support to access land

Land in Senegal cannot be bought. And because fertile, productive land, with access to water is limited, accessing land-especially large tracts for development- almost inevitably involves the transfer of land from communities to investors. If done sensitively and sensibly it works. If not, it can result in land grabs and blockages to successful implementation of the project.



### Lessons can be drawn from successful cases:

1

#### Identify land and de factor owner:

The traditional system of land rights means that it's not always clear who owns the land. Start by working with associations, local partners, state actors to identify suitable land. APIX can support to identify the "owners" of the land. They also moderate the discussions as one work to get community support.

2

#### The Delibération Step:

This is negotiated with the community, usually through the mayor& village chiefs. Through community discussion and debates involving the local village, residents, town etc they come to an agreement around their willingness to vest usage of the communal land to the investor. This also involves the community making clear what they expect in return by way of jobs, contributions to community development etc.

3

#### Formalise with a lease:

Land can be leased. This is managed through the state. A small annual fee is paid to the central government Small annual fee to the central government, an asset in loans

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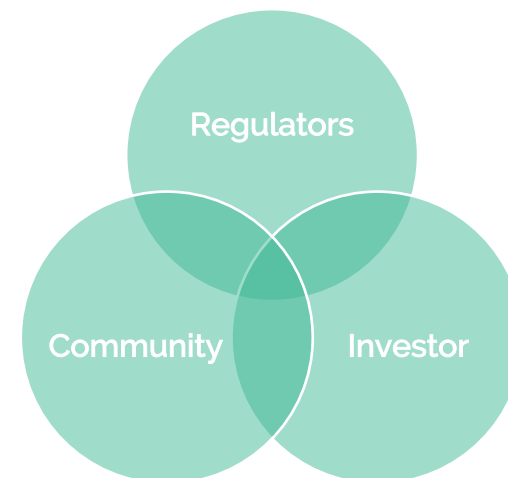
#### Secure Land Right Titles for critical infrastructure points :

Often issued for a small portion of the land you have. This is typically where you are making major capital investments, such as investing in pack houses etc.

5

#### Ongoing Community Relationship Building

The long term nature of orchard investments makes it especially critical for the relationship on both sides to be mutually beneficial. CSR efforts are a key part of sustainable investment activities. It builds trust, cements the role of the investment in the community and stabilises continued support of the and lease arrangement. Some initiatives include social welfare efforts such as access to water, clinics or improving schools. But building business linkages is another way to strengthen ties and a mutually beneficial relationship.





### Risk Analysis

#### **Market Risk**

The choice of vegetable crops to plant each season is based on anticipated market demand and price. Usually, farmers see what performed well this year and plant more of this the following year, resulting in over supply and low market prices.

#### **Disease pressure**

Potatoes in particular cannot be farmed on the same land year-on-year due to the build up of disease pressure. If this is not managed through a good crop rotation, the irrigation infrastructure would need to be moved.

#### **Salinisation of land or irrigation water**

If land is left to dry out ground water can rise through capillary action, precipitating on the topsoil. In addition, it is possible for salt water to penetrate several kilometres up the Senegal river.

#### **Land Invasions by herdsman**

With a chronic shortage of grazing in Senegal due to overgrazing desertification and climate change, there is increasing conflict between Fulani herdsman (Peule) and crop farmers. This may result in intercommunal clashes and farm invasions as it has in other countries in the region.



### Risk Mitigation

#### **Market Risk**

##### **Onions:**

The market for high quality, storable onions in Senegal remains undersupplied. In the event that Senegal produces a surplus of onions, markets exist in the region including Ivory Coast, Mali and Mauritania.

##### **Potatoes:**

With the appropriate facilities on farm to dry and store potatoes, they can be stored until market prices peak in June.

##### **Cabbages**

Cabbages can be sold off farm to traders, remaining in field until an order is received.

##### **Fodder crops**

While fodder is in desperately short supply in Senegal, herdsman are not accustomed to paying for it. It is therefore necessary to sell fodder at as lower price as possible. The current price paid is between FCFA 75 and 100/kg.

##### **Disease pressure**

This is mitigated by the crop rotation.

##### **Salinization**

Apart from some additional revenue, the main reason for farming a fodder crop in the off season is to keep the irrigated land in production and avoid salinization. In addition, sorghum has a very deep root system which can help drain salt water away from the surface, rehabilitating saline soils.

##### **Land Invasion by herdsman**

This is a very real threat to the stability of Sahelian nations. Large scale fodder production is the only practical solution.



### Economic & Social Impact

- The production of vegetables is very labour intensive and has the capacity to create considerable employment
- Production of vegetables for the local market improves food security in Senegal
- Vegetables are a healthy staple in the Senegalese diet
- Fodder production has the potential to build good relations with livestock farmers reducing the risk of farm invasions and intercommunal clashes



### Environment Sustainability

- The inclusion of a fodder crop in the rotation is a measure against salinization.
- If the 3<sup>rd</sup> cut is incorporated into the soil each year, the fertility, moisture retention and structure of the soil will improve over time.
- The choice of the Lac de Guiers region in the Senegal River valley allows the farm to operate large scale irrigation systems without competing for dwindling ground water resources.
- The cultivation of land in the north of Senegal, especially with the enrichment of soil through re-incorporation of fodder is an essential strategy against desertification.
- In addition, it reduces the pressure on scarce grazing which is a leading cause of desertification



### Women & Youth

- Women are primarily involved in the selling of vegetables in Senegal. This enterprise would provide revenue to thousands of women traders
- Jobs on farm, while menial offer employment for women and youth. In the small-scale system, the work is usually carried out by family labour (women and youth) however the land and revenue belong to the head of household who is usually an older male



### Knowledge Transfers

The Netherlands holds deep knowledge in the techniques and agricultural practices required to maximise yields and quality for potatoes and onion in general.

There are many opportunities to transfer knowledge around good agricultural practices, to develop new knowledge around onion seed optimised for saline conditions etc.

The Senegalese onion sector also can learn much from the Dutch onion sector about how to access regional markets, optimising systems to improve quality, volumes and the ability to service export markets.



### Commercial Interests

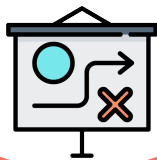
- There are many opportunities for Dutch producers and suppliers in this business model. Firstly, as investors Dutch onion exporters have the opportunity to retain share of the Senegalese market, even during the import ban. This is a key market for the Netherlands in the early part of the season.
- The outgrower model provides opportunities to get access to land through the Block Farmer System. Effectively, the land remains in the hands of locals, while the investor controls the quality and marketing of the end product.



### Technology

- Dutch technology is particularly relevant to the onion packhouse environment. Dutch suppliers of equipment, mesh bags and potentially cold storages solutions are all very relevant.
- The commercial company uses only imported seed and high quality inputs in the outgrower scheme. This provides an opportunity for Dutch companies to supply these inputs into the Senegalese market.





### State Institutions, Universities

#### **Extension Services**

ANCAR is responsible for coordinating extension services. They work through agencies that focus on specific tasks in the various regions.

#### **SAED**

Along the Senegal River Valley SAED , the Senegal River Development Authority is heavily involved in organising farmers and supporting their projects that involve irrigation. This include technical support. Working with SAED would be a sensible move as they are very aware of the local farmers, new areas for expansion, the topography etc.



### Private Sector

#### **La Banque Agricole (previously CNAAS), Banks & MFI's**

Access to finance and mechanisms to screen farmers requiring loans are all important elements to building an outgrower scheme with real value to farmers. Working with MFI's is thus sensible and beneficial for all stakeholders.

#### **Input dealers– seed, fertiliser, pesticides**

Quality inputs that are delivered on time is essential to achieving the volume and quality of onions required to make the business model financially beneficial to the lead farmer and the small scale producers. Working in partnership with one or many input dealers to secure the right inputs in full and on time is thus very useful. It also allows for a strong integration extension services with the input supplier.

#### **Mechanisation Service Providers**

A powerful bolt on to the outgrower scheme is in the conclusion of a mechanisation service provider. This is particularly valuable where harvesting services.



### Professional Associations

#### **IPOS**

This is the overarching association for he onion chain. They are increasingly active and are supported by the Dutch organisation PUM. They could be a helpful partner to identifying opportunities for mechanisation investors, locations, potential partners and coordinating efforts with equipment dealers.

#### **Onion Local Associations & Cooperatives**

Additional active local associations to consider are:

- GPAR (Union des Groupements et Agriculteurs de Rao)
- UFMT (Union Forestière et Maraîcher de Thieppe)
- APOQ ( Association des Producteurs d'Oignons de Qualités de Potou)
- UGPM (Union des Groupements des Producteurs de Mboro)



This business case was developed by Sense  
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