

# Technical-economic Study of Farming Systems in An Entrepreneurial Perspective. Case of the IDEAL 860 Farm (Thiès, Senegal)

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**Abstract**— Agriculture plays an important role in the economies of southern countries. In Senegal, we are increasingly witnessing, with the support of state structures or only through private initiative, the promotion of entrepreneurial-type agriculture to contribute, in particular to the increase in agricultural productivity and to the creation of jobs and income. However, if information exists on the results of productive agricultural investment made by state structures, it is lacking with regard to the abundant private initiative in recent decades. Thus, this work was carried out on the IDEAL 860 farm to analyze its economic performance through the production systems it implements. Qualitative and quantitative surveys of the main actors of this farm have shown that the production systems implemented are profitable because the receipts from plant and animal production are far greater than the costs borne, that employment and income have been created, despite constraints relating to a lack of rigorous application of technical itineraries. For existing production systems to increase the profitability of the IDEAL 860 farm, it would be necessary to establish a cropping calendar, design a pest control program, install a drip irrigation system for arboriculture and recruit a qualified workforce.

**Keywords**— Agricultural entrepreneurship: financial profitability: farm: farming systems.

## I. INTRODUCTION

The agricultural sector plays an important role in the economy of developing countries. However, its development comes up against several constraints because these countries will always be dependent on imports of agricultural products such as cereals, meat and milk, if their production is lower than their demand (FAO, 2002).

As far as he is concerned, the African continent has immense natural and socio-economic potential which should enable it not only to feed its population and to eliminate hunger and food insecurity, but also to become a major player in international markets. These are its natural resources such as land, water, particularly maritime and human resources (men and women), their know-how and its huge market (Mayaki, 2014). Aware of this opportunity, African Union took, a decade ago, the option of making agriculture one of the main pillars of the New Partnership for Africa's Development (NEPAD) (2014). Indeed, this sector represents an essential part of the economy of all African countries and 16% of the gross domestic product (GDP) of Sub-Saharan Africa (WB, 2020). This author also underline the crucial role that the farming sector must play in addressing the continental

priorities of eradicating poverty and hunger, boosting intra-African trade and investment, rapid industrialization, economic diversification, sustainable management resources and environment, job creation, security and shared prosperity. Dealing with innovation, Mayaki wrote that their adoption in order to increase agricultural productivity must correspond to the needs of producers and, insofar as they affect health and the environment, must concern all national communities of this continent. For farmers, innovation implies that they will take risks that they will consider as minimal if the environment is more predictable and incomes better assured to justify the adoption of new technical packages if access to land is more secured and prices are more stable and predictable. Insurance, safety nets for producers and input and products subsidies are also very important. Such an environment must also be characterized by more secure access to land, more stable and predictable prices, insurance and safety nets for producers. It should be noted that input and product subsidies are a proven means, particularly in developed and emerging countries, of reducing risk and increasing production (Mayaki, 2014).

According to ECOWAS (2015), West African agriculture is based on family farms which provide 90% of production, control 85% of farming land and fulfill various fundamental functions such as food security, natural resources management, economic growth and rural areas development. Its major problem is its low productivity and high post-harvest losses (FAO, 2015). This agriculture is often the victim of climatic hazards, parasitic attacks or soil degradation. The use of fertilizers is very low with an average of 8 kg per hectare, against a need of 150 to 200 kg/ha). Mechanization rarely exceeds the level of animal traction and the percentage of irrigated land is also very low, with 4% against 39.3% in South Asia and a world average of 20% (Fall, 2006).

Concerning Senegalese agriculture, is at the heart of the economy of this country and constitutes a priority for political authorities because it employs 2/3 of the working population. Its contribution to the GDP formation is 18% and it produces 69% of basic products for households (ANSD, 2017). In 2015, a growth effort of 6% was made for the entire agricultural sector, which increased agricultural GDP by 604 billion FCFA and reduced poverty by 12.6% (ECOWAP/PDDAA, 2009). Thus, it is estimated that the contribution to poverty reduction

due to agricultural growth would be higher than the one of other economic sectors.

However, we note emergence of a farming entrepreneurial type with diversified goals in some Senegalese localities. Public policies, programs and entrepreneurial structures favor private initiatives development. According to the Delegation for Rapid Entrepreneurship (DER), in 2020, the annual recovery rate was around 80%, which motivated this structure to finance more farming entrepreneurship.

High production factors cost and production systems that do not comply with entrepreneurial agriculture reflect the low competitiveness level of local production. Other constraints are low use of advanced technologies, management tools and quality units in most local agricultural enterprises and unqualified human capital.

This research aimed to answer following question: can production systems implemented in the IDEAL 860 farm improve its financial profitability? Its overall objective is to increase the financial profitability of this farm. Specifically, it was to:

- identify the production systems of the IDEAL 860 farm;
- analyze the profitability of these production systems and;
- identify the various constraints of these production systems in order to propose ways of improving the economic results of this farm.

The central hypothesis of our research is that the production systems of the IDEAL 860 farm are profitable. The working hypotheses are:

- the cultivation systems of the IDEAL 860 farm are financially profitable and;
- the breeding systems of the IDEAL 860 farm are financially profitable.

## II. PRESENTATION OF THE SITE, MATERIAL AND METHODS

### 1. Presentation of the Thiès Region and the Ideal 860 Farm

The Thiès region is one of the 14 administrative regions of Senegal. It is located in the west of the country, at 70 km from the national capital, Dakar. This region covers an area of 6,601 km<sup>2</sup> or 3.4% of the national territory.

#### Physical data

The Thiès region has a relatively flat relief, except for the Thiès Plateau which rises to an altitude of 105 m, the Diass massif which rises an altitude of 90 m and the Thiès basin which extends over an area of 65 km<sup>2</sup>. These geological forms contain a lot of wealth (limestone, basalt and attapulgitic phosphate).

The main types of soils are: leached sandy-textured tropical ferruginous soils called "dior soils" which make up 70% of cultivable areas; sandy-clay-textured tropical ferruginous soils called "deck-dior" which make up 15% of cultivable areas; leached clay-humiferous tropical ferruginous soils called "deck" which make up 10% of cultivable areas and hydromorphic soils with humiferous texture called "shallow soils" and which make up 5% of cultivable areas (ANSD/SRSD, 2013).

The vegetation is composed of shrub plants, which constitute a degraded shrub savannah scattered with mono-specific stands: *Acacia seyal*, *Adansonia digitata*, *Faidherbia*

*albida* and *Borassus flabellifer*; the filao band in the Niayes and plantations of the classified forest of Bandia (*Eucalyptus* and *Prosopis juliflora*), thirteen (13) classified forests with an area of 94 473.6 ha, i.e. a classification rate of 14.3%.

Wildlife can be divided into two classes: animal hair consisting of small ruminants and rodents, and avian fauna represented by migrating palearctic birds near water points. The region has significant groundwater (from the Continental Terminal, Paleocene, Eocene, Maastricht and coastal sands) and surface waters (Lake Tanma, the Somone Lagoon and two retention ponds). The well water has a relatively good quality (salinity is less than 0.3 g/l) but contains, in some places, excess iron and fluorine, as in the Fissel and Ndiagianiao areas.

In the Thiès region, four ecogeographical zones have been identified: the great coast called the zone of the north coast or the coastal zone of the great Niayes containing important hydroagricultural potentialities which make it an area of intense market gardening activities. The great coast is also home to extractive and chemical industries and fishing activities such as Cayar and Fass Boye and livestock farming. As for the small coast, its opening to the sea, its mild temperatures have given it a touristic vocation. It is also an important fishing area, with important landing points such as Mbour, Joal and Ndayane, and part of the peanut basin occupying, mainly, the eastern part of a route passing through the localities of Mékhé, Tivaouane, Thiès, Nguékhokh and Mbour. The soil is degraded by the practice of a long groundnut monoculture, the area known as the massifs is enclosed within a space between the Thiès, Mont-Rolland, Pout, Sébikotane, Diass, Sindia and Diobass localities.

#### Demographic situation

The Thiès region is experiencing significant population growth. From 2002 to 2015, its population increased from 1,331,916 to 1,889,318, an increase of 41.8% in 13 years. Census population projections estimate the resident population of this region at 2,162,833, or 12.9% of the national population (ANSD, 2020).

#### Administrative organization

The Thiès region is divided into three departments: Mbour, Thiès and Tivaouane. It comprises twelve arrondissements, fifteen urban communes and thirty-one rural communes.

#### Economic aspects

The Thiès region is a major center of agricultural production, thanks to its hydraulic and soil potentialities. Agriculture in Thiès occupies an important place and is practiced in three areas:

- the coastal zone of the Niayes, with a market garden and fruit growing vocation;
- the central area, with a peanut, arboreal and cassava vocation and;
- the southern zone, with a market garden and food production (ANSD, 2013).

In terms of breeding, the Thiès region is home to several species, 886 630 head of which almost a third (33.1%) are sheep. The department of Mbour has the largest number of animal species, with 45.9%. The livestock sector therefore has a definite impact on regional development (fattening, poultry

farming, dairy farms and the use of horses in urban and rural transport). Nevertheless, it has some constraints such as:

- extensive farms;
- frequent theft of livestock;
- low productivity of local breeds;
- insufficient veterinary care;
- scarcity of pasture in the dry season;
- non-effective application of the Agro-Sylvo Pastoral Orientation Law (LOASP) of 2004 with, as a corollary, the non-visibility of livestock routes in land management;
- insufficient water sources for watering livestock and;
- frequent conflicts between farmers and ranchers due to animal movements (ANSD, 2013).

Till 2007, the industrial fabric of Thiès had 18 industrial units, most of which were located in Thiès and Tivaouane departments. This situation is beginning to change, with the emergence of new agro-food units in the department of Mbour (canneries, ice units and mineral water exploitation, in particular). The quarrying sites, 55 in 2008 compared to 48 in 2007, a net increase of 7 sites, contain basalt (17 quarries), willow (12 quarries) and limestone (10 quarries). These quarries are located in the areas of Bandia, Diack and Pout (ANSD, 2013).

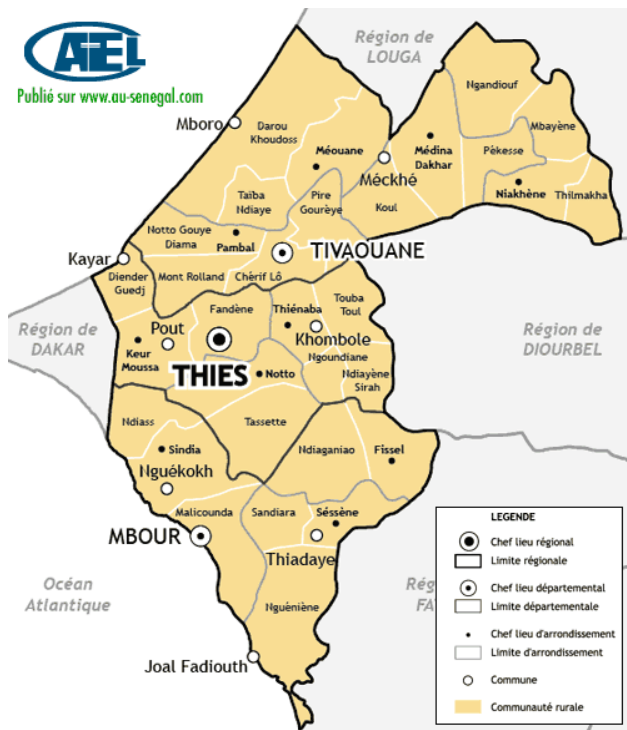


Fig. 1. Administrative map of Thiès region. Source: ARD

### The IDEAL 860 farm

The IDEAL 860 farm is located in the Thiès region, municipality of Thiénaba, 500 m north of the village of Keur Ibra Niane which is 7 km east of the National Higher School of Agriculture (ENSA). It was purchased for large-scale agricultural production. Various activities are carried out here: vegetable production (market gardening, fruit and fodder cultivation), animal and fish production.

Through the agricultural entrepreneurship implemented, this farm allows its promoter to make a profit thanks to the production systems put in place. It employs a paid labor force for activities management. In addition to the activities carried out there, the owner intends to make the farm a training center in agropastoralism where he will share his knowledge with any interested person whatever his study level.

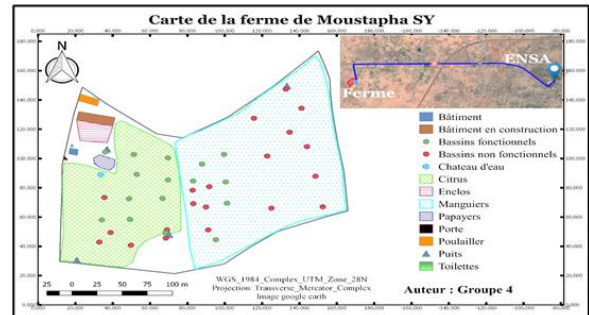


Fig. 2. Map of the IDEAL 860 farm. Source: Dieng (2019)

### 2 Material

Used equipment to carry out this work consists of the following:

- a questionnaire and interview guide for farm managers and workers;
- a camera for taking pictures;
- a pen to fill out the questionnaire and;
- a laptop for data entry and memory writing.

### 3 Methods

The methods used are literature search, field observation, and quantitative and qualitative survey. The data was collected from March to April 2021 and processed and analyzed using Word and Excel 2013 versions.

## III. RESULTS AND DISCUSSION

### 1 Results

#### A. Identification of contractor and workers

The contractor is an agricultural engineer. He lives in the region of Thiès where he develops his agricultural activities. In addition to the contractor, there is the farm manager who coordinates all activities within the farm. He has at his disposal four workers responsible for the conduct of the animals, namely their feeding, watering and cleaning. They also maintain the crops. A maid is employed to prepare meals for farm staff.

Table 1 shows the age of agricultural workers, with an average of 27 years; the maximum age is 32 years and the minimum age is 22 years.

TABLE 1. Age of IDEAL 860 farm workers

Farm worker	Age
1	32
2	28
3	25
4	22

**B. Identification of the farm**

**IDEAL 860 farm area, year and method of acquisition**

Purchased in 2018, the IDEAL 860 farm has an area of 6 ha.

**IDEAL 860 Farm Activities**

The main activities carried out within the farm are: arboriculture, poultry farming, sheep, goat and cattle farming, market gardening and small-scale fodder farming.

**IDEAL 860 farm infrastructure**

The farm has a two-bedroom building and two toilets for accommodation and staff needs (workers). A water tower with a capacity of 12 m<sup>3</sup> is set up for the farm’s water supply (livestock feed, human feed and plant irrigation). The latter is filled by a pump immersed in a well 18 m deep. A nine-panel solar photovoltaic system supplies the farm with energy: eight panels are designed for the operation of the pump, while the last one covers the energy needs of the housing.

**IDEAL 860 farm water sources**

The IDEAL 860 farm has four (4) wells, a borehole and a water tower. Both (2) wells are non-functional. This can be explained by the drying period (from February to May) and the drying due to the boreholes dug in the area. In addition to this, the area is home to the Dangoté cement plant, which uses huge amounts of water.

**IDEAL 860 farm water quality**

Use of solar energy as a source of energy and the availability of a water tower make the farm self-sufficient in water. The latter being neither brackish nor fluorinated, with a low limestone content is very suitable for irrigation as well as for human and animal feed. The IDEAL 860 farm has fresh water.

**IDEAL 860 farm irrigation system**

Water is supplied by the farm’s eight solar pumps.

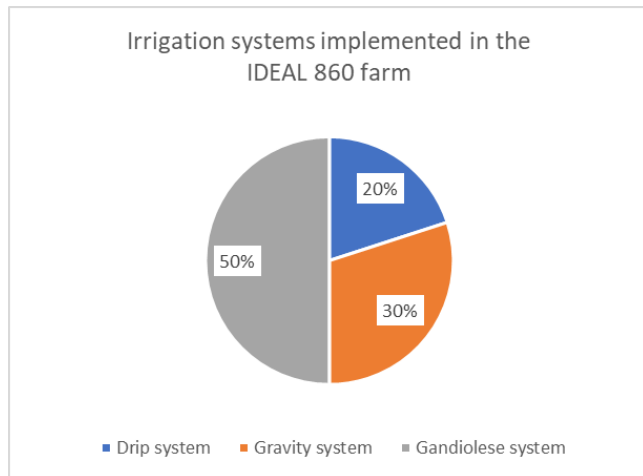


Fig. 3. Irrigation systems in the IDEAL 860 farm

Figure 3 shows that the IDEAL 860 farm has three irrigation systems: a gandiolese system with 59 basins, a drip irrigation system fed by pumps that draw directly from the borehole, and a gravity system fed by the water tower.

**A. Plant production**

**Area occupied by plant production activities**

The cultivation systems (market gardening and fruit growing) cover a total area of 5.5 ha.

**IDEAL 860 farm equipment**

Table 2 shows that, since 2018, IDEAL 860 has invested in the acquisition of a diversified operating capital, consisting of a transport equipment represented by 1 4X4 L200 vehicle, infrastructure such as 1 drilling, 1 water tower and 4 wells accompanied by 59 basins and 63 taps and a small agricultural equipment consisting of 8 watering cans, 4 hilars and saws, 3 hoes, 2 shovels and 1 hoe sine, fork, rake, wheelbarrow and cutter).

TABLE 2. IDEAL 860 farm operating equipment

Equipment	Number	Year of acquisition or construction	Use
L200 vehicle	1	2018	Transportation of Inputs, crops and broilers
Drilling	1	2018	Irrigation, watering and drinking
Water tower	1	2018	Water reservoir
Well	4	2018	Irrigation
Basins	59	2018	Watering the trees
Faucet	63	2018	Water supply
Hoe sine	1	2018	Weeding
Hilary	4	2018	Tillage and weeding
Saw	4	2018	Maintenance pruning
Hoe	3	2018	Weeding
Shovel	2	2018	Digging, cleaning the chicken coop, planting
Fork	1	2018	Straw cleaning and distribution
Rake	1	2018	Cleaning
Wheelbarrow	1	2018	Transportation
Cutter	1	2018	Cuttings
Watering can	8	2018	Watering

**Developed crops and sown areas**

The main agricultural activities developed on the farm are: fruit-growing, market gardening and fodder cultivation. Arboriculture occupies an area of 4.52 ha, of which 3 ha for mango trees, 1.5 ha for lemon trees and 285 m<sup>2</sup> for papaya trees. The market gardening and fodder cultivation are done under trees.

**Fruit trees grown on the farm IDEAL 860**

Table 3 shows the results that the IDEAL 860 farm planted 727 fruit trees, of which slightly more than half (50.5%) are mango trees, with 367 feet, slightly more than one quarter (27%), is composed of lemon trees, 9% are composed of papaya trees, 7% tamarind trees, 4%, banana trees, 2%, cashew trees and 0.5% of Soursop.

TABLE 3. Fruit trees grown on the farm IDEAL 860

Fruit tree species	Number
Mango tree	367
Lemon tree	195
Papaya	63
Tamarind tree	55
Banana tree	29
Cashew tree	14
Soursop tree	4
<b>Total</b>	<b>727</b>

TABLE 4. Vegetable speculations and number of planks

Speculation	Plants number
Onion	19
Sorrel	13
Mint	12
Lettuce	11
Tomato	10
<b>Total</b>	<b>65</b>

In addition to fruit growing, Table 4 shows that the farm also grows market garden speculations such as onion, with 19 planks, lettuce, with 11 planks, and mint, sorrel and tomato.

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The farm does not have a specific cultural calendar. Crops such as mint are made to order and others such as onion and sorrel are grown on demand on the market.

*Purchase of inputs at the IDEAL 860 farm*

The seeds are purchased at the “Foaming” market in Thiès and their price varies according to the speculations and varieties chosen. The choice of the variety is determined by various parameters: the growing period, the type of soil, the production cycle, the types of products to be marketed, the purity of the seeds and the yield. For example, during wintering, the farm prefers to purchase onion seeds of the F1 Quartz variety rather than the Galmi Violet variety, which is often used at the end of wintering.

*Types of crops grown in the IDEA 860 farm*

Pure cultivation, crop association, crop rotation and rotation are the different types of cultivation practiced on the IDEAL 860 farm. However, crop rotation is the most practiced.

*Cultivation operations in the IDEAL 860 farm*

In order to optimize agricultural profitability, IDEAL 860 farm workers use all types of cultivation (plowing after the winter period to better decompress the soil, weeding, hoeing and clearing).

*Type of fertilization applied in the IDEAL 860 farm*

Reasonable fertilization is adopted for environmentally responsible production. After cleaning the poultry houses, poultry droppings are used as fertilizer for lemon trees. Mineral fertilizer 15-15-15 is also used. However, the dose is not respected and the period of application is not respected. Fertilization is carried out three to four times a year with a dose more or less equal to 50 g per foot.

*Spacing applied by speculation in the IDEAL 860 farm*

As regards spacing, the holding refers to the various technical sheets already designed by the Senegalese Agricultural Research Institute (ISRA) and the Horticultural Development Center (CDH).

*Most common diseases on the IDEAL 860 farm*

Different diseases and pests have been encountered on trees.

*Anthraxnose*



Fig. 4 and 5. Mango trees from IDEAL 860 farm and mango leaves affected of anthracnose

Mango trees from IDEAL 860 farm and mango leaves affected Figure 4 and 5 show photos of mango trees and mango leaves affected by anthracnose, a disease caused by the fungus *Colletotricum magifera*. It is manifested on the leaves by black spots that widen, dry and are found under the action of the wind. On the twigs, there is a gradual drying of the apex. This disease has led to a significant decrease in yield.

*Gommosis*



Fig. 6. Trunk of a lemon tree with gommosis

Figure 6 shows a trunk of a lemon tree with gum, a disease caused by *Phytophthora citrophthora* and manifested by wounds in the trunk and some carpenter branches, with gum flowing. It causes a gradual drying of the twigs and is deadly in the virulent state.

*Cochineal diaspine*



Fig. 7. diaspine cochineal of lemon tree

Figure 7 shows a lemon tree leaf attacked by the diaspine scale. In the form of a stick, these scale insects adhere to the upper face of the leaves and to the fruits. They degrade the commercial value of the fruit, the price of which can drop by half.

Mealy scale



Fig. 8. Mealy scale of lemon tree

Figure 8 shows lemon tree leaves affected by the mealy scale, which is a sucker, with a cotton-like appearance. It attacks fruits and leaves. We observed that the sucker secreted honeydew that attracts ants and manifests itself in small fruits covered with a whitish substance.

Vegetable crops are also sometimes attacked by nematode and termites. The nematode attacks vegetable crops and manifests itself by the formation of scabies on the roots, inhibiting the development of the plant. Termites, on the other hand, devour the radicals, the outer parts of the roots, the trunk and the dry branches. This leads to a gradual drying of the foliage, which, in the long run, makes the plant unable to photosynthesize and, consequently, causes its death. Fungal diseases caused by fungi are also present.

*Types of treatments applied in the event of an attack*

Despite the various enemies of the crops identified, no phytosanitary program has been established. However, the interview with the market gardening production manager allowed us to know the plant protection treatments applied. Thus, the use of pesticides on the farm is at different stages of the plant's growing cycle. Thus, the main products used are Arsenal (6 L/ha), Bomec (6 L/ha), Abomec (12 L/ha) for insects and mites, sulfur (10 kg/ha) for mushrooms and mites and mancozeb (5 kg/ha) for mushrooms applied with a sprayer.

*Number of employees on IDEAL 860 farm*

The farm being made up of different activities requires a large and permanent workforce. The farm has four (04) farm, livestock and a housekeeper who prepares meals.

*Improving agricultural profitability*

The workers often use a variety of cultivation practices such as rotation, rotation, organic amendment and pruning of fruit trees to improve yields. They often grow peanuts to reduce the nematode population.

*Farm production systems IDEAL 860*

Table 5 shows the five vegetable speculations grown on IDEAL 860.

TABLE 5. Market gardening on the IDEAL 860 farm

Speculation	Agricultural practice
Onion	Reasonable fertilization, fungicide application, hoeing and weeding
Tomato	Plowing, organic fertilization and weeding
Lettuce	Organic amendment and hoeing
Sorrel	Weeding
Mint	Organic amendment and hoeing

TABLE 6. IDEAL 860 farm production systems

Production factor	Crop production	Animal production
Area	5.5 ha	0,12 ha
Workforce	Salary (120,000 FCFA)	Salary (60,000 FCFA)
Used tools	Hoe, hoe-sine, hoe, hilar, fork, rake, wheelbarrow, shovel, cutter	Drinker, feeder, gas brooder
Practical	- Agro-ecology, with the addition of organic fertilizers - Crop rotation - Crop rotation	- Semi-intensive for sheep and cattle breeding
Daily working time	08 h	08 h

Table 6 shows the components of the LEAD60 farm's production systems, both plant and animal, with a paid labor force performing the various tasks. The 5.5 ha crop production relies heavily on organic fertilization to optimize production. In addition, there are different cultivation practices such as rotation and rotation. The authorized working time is 80 hours per day.

*Marketing of products*

The IDEAL 860 farm works directly with the banas-banas that buy the products in the field. It also collaborates with companies involved in the marketing of agricultural products. One example is Bichri Holding, a company of young Thiès people and Dakarese who buy the products of the IDEAL 860 edge farm and then sell them to private individuals. In general, there is no difficulty in marketing the farm's production.

*Fees for plant production*

We did not have all the expenses related to the various speculations due, in particular, to the lack of accounting on the holding. Nevertheless, we were able to collect some data that allowed us to calculate the economic results obtained by the IDEAL 860 farm.

TABLE 7. Charges for fruit and vegetable growing

Rubric	Quantity	Unit price	Total price
Plowing	5	50 000	250 000
Seeds	1	25 000	25 000
Fertilizer	4	14 000	56 000
Fuel	50	695	34 750
Phytosanitary products			60 000
Workforce	4	60 000	40 000
Miscellaneous			50 000
Total			715 750

Table 7 shows the different loads related to plant production. The majority of these are plowing, which accounts for 35% of expenses, and labor, which in turn accounts for 34% of expenses. Seed accounts for only 3.5 per cent of expenditures.

*B. Animal production*

*Area occupied by animal production*

Animal production occupies approximately 1,200 m<sup>2</sup> of the total area of the farm.

*Livestock-specific infrastructure*



Fig. 9. Chickens, with feeder, watering troughs and subjects

Figure 9 shows that poultry is grown on the ground in a two-barn building, each with a surface area of 54 m<sup>2</sup> (540 chickens) and another with a surface area of 302 m<sup>2</sup>, which can hold up to 1,000 birds. The orientation of the buildings is East-West, which allows a microclimate favorable to animals. Natural ventilation is provided by openings on the faces of the walls. The single-slope roof is made of metal, which can cause an increase in the internal temperature of the chicken coop. The farm's livestock equipment consists essentially of 24 feeders and 20 drinkers for feeding chickens, a solar lamp for lighting and a gas rearing machine for heating 1,000 chicks. Currently, the driving range is 950 subjects.

*Animal species reared on the IDEAL 860 farm*

On the farm, broilers, sheep, cattle and goats are raised.

*Sheep reared on the IDEAL 860 farm*



Fig. 10. the sheep flock of the IDEAL 860 farm

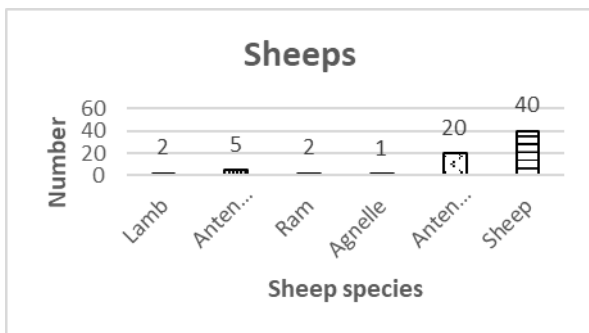


Fig. 11. composition of the sheep flock of the IDEAL 860 farm

Figures 10 and 11 show, respectively, the sheep of the IDEAL 860 farm and their composition. In total, the sheep population on the farm is 68 head. According to age and sex, Figure 11 shows that ewes are more represented, with 40 heads, followed by antennas, with 20 heads, antennas, 5 heads, the rest being lambs, ram and lamb.

The farm also has goats consisting of 5 goats and a goat. *Cattle reared on the farm IDEAL 860*



Fig. 12. The cow and calf of the IDEAL 860 farm

Figure 12 shows the IDEAL 860 cattle farm, with a herd consisting of two heads: a cow of Jersey breed and its calf. It is an Anglo-Norman dairy breed with an average production of 12 l/day.

*Method of animal acquisition*

Animals are purchased with the exception of lambs born on the IDEAL 860 farm. The contractor obtains supplies from two sales outlets, one in Mbirkilane and the other in Daara Jolof.

*Method of feeding animals*

For chicken feed, the farm is supplied by the new African flour mill (NMA) Sanders. The food is in the form of grains, the distribution is manual and is done every day (morning at 09:00 and evening at 17:00) by workers. Consumption is around a bag and a half a day.

Feeding of sheep and goats is mainly based on grazing. The plant cover consists of herbs that are very popular with livestock, such as *Chloris prierii* and *Pennisetum purpureum*. Thus, grazing is generally done every morning from 9 am to 1 pm and in the evening from 4 pm to 6 pm. Two two-kilogram licking stones are made available to meet their needs for mineral salts or trace elements to compensate for or avoid possible food deficiencies. In addition to grazing (in the morning), the cattle receive in the evening concentrated feed (wheat bran) marketed by NMA Sanders. This is to improve their productivity.

*Quantities of food used and prices*

For startup, a 50 kg bag of food is used per day, unlike the growing season when food is more frequent, with an average of two bags per day. Roughly 17 bags of starter food are consumed per strip compared to 56 bags of growth. Food bags are purchased at 14,600 CFA francs. The livestock units are managed by 3 workers, including the person responsible for all the activities on the farm, who is primarily responsible for supervising the activities. The animals are housed because they are raised in pens.

*Most Common Diseases*

Specifically, no specific diseases are encountered. This can be explained by the preventive treatments given on the 15th and 30th day by the workers.

*Veterinary care*

The farm is stocked with chicks by a veterinarian. Prior to supply, the chicks first receive HN9. Once there, they are

given a vaccine against Gumboro disease (infectious bursitis), aviprotrm gumboro. Limoxin mixed with carbonate and Aminogrow WS are used for stress control and as antibiotics, respectively. For sheep and goats, ivomec is often used to treat certain infections.

*Charges related to animal production*

Table 8 shows all poultry loads amounting to 1 656 000 CFA francs. Food accounts for the majority of expenses with a representativeness of 70.5%.

TABLE 8. Broilers Production Expenses

Rubric	Quantity	Unit price	Total price
Chick	1 000	460	460 000
Food	80	14 600	1 168 000
Hb1 1000 doses	2	5 000	10 000
Gumboro	2	9 000	18 000
<b>Total</b>			<b>1 656 000</b>

*Products of animal origin marketed*

For now, the farm sells broilers and sheep.

*Marketing and Pricing*

The chickens are slaughtered and sold at 1,700 CFA francs per kg. The main clientele is the Alioune Diop University (UAD), the University of Thiès (UT), the Ecole Normale de Dakar, the Lat Dior Residence in Thiès.

As for the sheep, their price depends on the projects. For example, if the broodstock is involved, the prices applied are between 400 and 500,000 CFA francs. It may also depend on blood and blood. For example, sheep of the *touabir* breed can be sold for 60,000 CFA francs.

*C. Identification of the economic situation of the IDEAL 860 farm*

*Sources of operating income*

The farmer derives his income from the lessons he gives, from animal and plant production.

*Expenditure by the operator*

This is considered to be the total expenditure on animal and plant production and on wage labor and food, which makes a total of 8 011 750 CFA francs (715 750 + 5 640 000 + 1 656 000).

Table 9 shows the loads associated with crop production. They amount to 715 750 CFA francs. The unit cost of production (one ton) is estimated at 121 062 CFA francs.

TABLE 9. Expenditure on plant production

Rubric	Quantity	Unit price	Total price
Plowing	5	50 000	250 000
Seeds	1	25 000	25 000
Fertilizer	4	14 000	56 000
Fuel	50	695	34 750
Pesticides			60 000
Workforce	4	60 000	240 000
Miscellaneous			50 000
<b>Total</b>			<b>715 750</b>
<b>Unit cost of production</b>			<b>121 062</b>

Table 10 shows the expenditure on animal production, which is estimated at 1 656 000 CFA francs. They concern chicks, food and prophylactic products. The unit cost of production is 1,743 CFA francs, for the 950 high subjects.

Table 11 shows the labor costs of the LEAD60 farm. It amounts to 5,640,000 CFA francs annually.

TABLE 10. Animal production expenditure

Rubric	Quantity	Unit price	Total price
Chick	1 000	460	460 000
Food	80	14 600	1 168 000
Hb1 1000 doses	2	5 000	10 000
Gumboro	2	9 000	18 000
<b>Total</b>			<b>1 656 000</b>
<b>Unit cost of production</b>			<b>1 743</b>

TABLE 11. Salary Expenses

Rubric	Monthly payment	Annual cost
Leader	150 000	1 800 000
Worker 1	60 000	720 000
Worker 2	60 000	720 000
Worker 3	60 000	720 000
Domestic	50 000	600 000
Meal	90 000	1 080 000
<b>Total cost</b>		<b>5 640 000</b>

*Operating revenue and break-even point*

*Gross margin*

The gross margin (MB) is calculated as follows:

Unit Price - Unit cost of production. Thus,

MB (broiler) = 2,500 CFA - 1,743 CFA = 757 CFA

*Current profitability threshold*

The current break-even point is obtained by dividing the total cost of production over the selling price. Thus, we have: 1,656,000 CFA francs / 2,500 CFA francs = 662.4. This represents the amount to be produced to balance expenditure and revenue. Thus, to make a profit, one needs a production > 662.4 subjects; this is the case here (950 > 662.4).

For the break-even point, the following formula has been adopted in terms of turnover:

Fixed Expenses (CF) + Unit Variable Expenses (UCV)\* Quantity Produced (N) = Unit Selling Price (UVP) \* Quantity Produced = Turnover, which allows for the derivation of:

$$N = CF / (PVU - CVU) = CF / MB$$

N is the quantity to be produced to be profitable; the break-even point is obtained by this calculation: SR = N \* PVU.

The production of the lime tree requires a turnover of 6,333,489 CFA francs to be profitable; for the lemon tree it requires a turnover of 1,676,558 CFA francs to be profitable; for the brigadier it requires a turnover of 2,375,058 CFA francs to be profitable.

Table 13 shows all the LEAD60 farm's income from tree and poultry farming and the results of the activities. Poultry farming generates revenue worth 2,375,000 CFA francs, while fruit growing provides the largest share of the revenue, with an income of 24,3 million CFA francs.

Based on the unit production costs and sales prices calculated above, we see that the overall results are positive; this suggests that the promoter is making profits both on animal production (CFA 719 000) and on plant production (CFA 14 580 000).



TABLE 12. IDEAL 860 farm income

Product	Product Yield	Total production (T) or subject (chickens)	Unit price (FCFA)	Total revenue (FCFA)	Gross margin on variable costs	Fixed charges (FCFA)	Profitability threshold
Lime tree	250 Kg/pied	39	500 000	19 500 000	378 938	4 800 000	4,2
Lemon tree	250 Kg/pied	9,75	300 000	2 925 000	178 938	1 000 000	7
Brigadier tree	250 Kg/pied	3,75	500 000	1 875 000	378 938	1 800 000	4,2
Total citrus				24 300 000			
Chickens		950	2 500	2 375 000	757	600 000	662,4
Total revenue			26 675 000				

A profit of 30% is made on broilers and 60% on plant production. However, with a more detailed analysis through the break-even points performed, we see that the revenue of the brigadier is below the break-even point (3.75 < 4.75). In other words, the developer would have to produce at least one ton more to make a profit from this speculation.

*Assessment of the activities profitability*

According to the contractor, he earns more revenue than his expenses. This suggests the realization of profit. However, the investments are a bit heavy and everything is done on own funds; this is confirmed by the operating results calculated above.

TABLE 13. Profitability of agricultural activities

Rubric	Animal production	Crop production		
		Brigadier tree	Lime tree	Lemon Tree
Recipe	2 375 000	1 875 000	19 500 000	2 925 000
Gross margin on variable charges	757	378 938	378 938	178 938
Break even	662,4	4,2	4,2	7

2 Discussion

The IDEAL 860 farm has an area of 60 ha. This area is higher than the results of Paquette and Sarale, 2019, according to which farmers in the Thiès region have an area of less than 50 ha. This difference can be explained by the fact that the contractor acquired his farm by purchase. This means that he can obtain the desired number of hectares according to his means.

On this farm, various activities are developed: market gardening, fruit tree farming, small-scale fodder farming, poultry farming, sheep, cattle and goat farming. These results are in line with those of FAO 2021 in its agrarian diagnosis conducted in the South of the Thiès region.

IDEAL 860 farm inputs are purchased at the Moussante market in Thiès. They are generally developed by local companies such as TRAORE ET FILS, SPIA... Contrary to the official statistics of the ANSD 2013 which discovers that the seeds marketed come mainly from France and Spain, but also from China and the United States with presence rates on the national territory of more than 5%. However, 62 different countries of origin are recorded for seeds circulating in the country, with the exception of mixtures that are not classified and of different origin, which represents 0.6% of the total (ANSD, 2013).

The farm has a well, a water tower and four (4) wells, two (2) of which facilitate access to water. This is confirmed by the FAO (2021) finding that some farmers in the area have access to water through wells or boreholes.

The existing irrigation system consists mainly of the gandiolese system followed by the gravity system and the drip. These results are inconsistent with those of FALL (2000) who found that the existing irrigation systems are primarily drip and spray.

The farm has two cattle, 68 sheep and 5 goats. These results are inconsistent with those of Fall (2000), which found that farmers in the area had, on average, ten cattle and small ruminants. This is due to the fact that the cattle of the Jersey breed are reared in order to form a breeding nucleus. No production tracking sheet is designed. Due to their low level of education, the workers are limited only to production activities. As for the implementation of monitoring activities, they do not have the skills to ensure this.

The farm is well equipped with agricultural infrastructure and equipment. It has a well, a vehicle, a water tower, wells and basins and small agricultural equipment. This is not in line with the FAO (2021) results which found that the majority of farms in the area have manual tools. This is justified by the lack of resources of some farmers who cannot afford to buy certain equipment.

The integrated system (Cochet, 2011) is that adopted on the farm, with crop production (arboriculture, market gardening and fodder cultivation) on the one hand and animal production on the other hand. A package of technologies is combined with specific tools in order to achieve quality production. From sowing to harvesting, the crops are maintained by the workers and, the techniques differ from one worker to another, according to the production manager.

IDEAL 860's farm production system is that of an entrepreneurial operation with a local investor who is no one but the entrepreneur. This result is reflected in the FAO 2021, which classified production systems into six parts: small family farms with subsistence rainfed agriculture, family farms with cassava for sale, small family farms with off-land poultry farming, family farms with off-season production, small employer farms with domestic investors and employees, and very large export-oriented farms.

The financial analysis of the production system shows the total costs and revenues of the IDEAL 860 farm, which will make it possible to decide on its profitability or not. It showed the difference between the expenses and revenues of the

operation. This difference is positive and constitutes an operating profit equal to 23,585,000 CFA francs.

As regards crop production, specifically fruit growing, the difference between revenue and expenditure is positive. In fact, expenditure is estimated at CFA 715,000 and revenue at CFA 24,300,000. However, the farm is subject to regulations requiring it to pay a single global contribution, the amount of which is confidential, according to its manager. Despite this, the gap remains positive. Most of the revenue comes from fruit growing, which produces high quantities, with attractive selling prices.

These results contradict those of FAO (2021) which concluded that total household income (agricultural income + non-agricultural income) remains, for the majority of production systems, below CFA 800,000. This difference can be justified, on the one hand, by the area of the farm greater than those found in the FAO classification and, on the other hand, by its relatively good supply of agricultural infrastructure and equipment. These results are also different from those of Touré, Konipo and Diagne (2021) studying the economic and financial profitability of cotton farms in the CMDT areas of Koutiala and Fana, highlighting the causes of the level of profitability at the two sites. These authors concluded that this activity was not economically profitable due to a IRR of only 3% in all CMDT zones but stated that "only producers in the Fana zone have a positive IRR of 15% on average, and become economically profitable when considering the 12% threshold set by credit institutions". This difference with the economic results of the IDEAL 860 farm can be explained by the fact that in these two areas, several family farms were studied.

#### IV. CONCLUSION

The IDEAL 860 farm with an area of 6 ha comprises two parts, one with an area of 4.5 ha is reserved for plant production and the other with an area of 0.12 ha is dedicated to livestock production. Vegetable production consists of market gardening and fruit growing. The latter concerns the following speculations: mango, citrus, papaya, soursop and banana. The first two crops are for marketing while the others are mainly for consumption. Breeding is mainly carried out on broilers, sheep, goats and cattle. Broilers are intended for consumption and marketing. The cow of Jersey breed is reserved for milk production while the sheep and goats, subjected to a semi-intensive breeding system, are reared to form a breeding nucleus.

The financial profitability analysis showed that the difference between crop production expenditure and revenue is positive. This suggests that crop systems are cost-effective. However, investments were not taken into account as some data such as acquisition costs were forgotten. This explains the fact that the income (24,300,000 CFA francs) far exceeds the expenditure (715,000 CFA francs). Therefore, the first hypothesis is confirmed.

The second objective was to show how farming systems are cost-effective. The verification of this objective No. 2 requires the evaluation of certain parameters. Thus, a comparison between expenditure and revenue from animal

production was made. This showed that the estimated income of 2,375,000 CFA francs far exceeded the expenditure of 1,656,000 CFA francs, i.e. a gross margin of 719,000 CFA francs. The results showed that the central hypothesis of the research is confirmed.

However, despite the different successes of the production systems, several constraints have been observed in this farm, namely:

- lack of cultural calendar,
- no established phytosanitary program (treatment as required),
- hand watering system for tree-growing activities,
- failure to apply technical routes rigorously,
- overloading of poultry houses and,
- insufficient fodder cultivation.

Based on these limitations, the following recommendations were made:

- agronomically:
  - establish a crop calendar for vegetable production,
  - design a plant health control program,
  - avoid overcrowding of poultry houses, in other words, respect the densities of occupancy of the poultry houses and further air them,
  - produce fodder on a large scale,
  - install a drip irrigation system and,
  - rehabilitate non-functional wells to increase water sources.
- Socio-economic and management:
  - to strengthen the capacity of agricultural workers for plant-health treatment,
  - recruit an agricultural engineer who will coordinate all the farm's productive activities; and
  - develop and use comprehensive management tools to record all farm data.

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