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Socio-technical Analysis of Pig (Sus Scrofa Domesticus, Linnaeus, 1758) Breeding in the Fimela Commune of the Fatick Region of Senegal

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Abstract— *A systematic study was conducted among 78 farmers in the commune of Fimela in Senegal to describe the characteristics of pig production. The results showed that the proportion of female pig owners (67.9%) is higher than that of male owners (32.1%). The average age of the farmers is 46.48 ± 12.98 years and ranges from 24 to 75 years. The herders are all Serer and are mostly married (68%). They are mostly Christians (93.6%) and are educated (78%). Nearly (24.4%) of respondents associate pig farming with agriculture. Pigs are raised in three different ways: stabling (46.2%), semi-stabling (41%) and roaming (12.80%). The main breeds raised are the local breed, the large-white breed and the mixed breed with an average size of 12± 9.04 animals per farm. The piggeries are traditional dwellings (75.6%), 59% of which are unroofed pens. The pigs are fed kitchen scraps, meal scraps and industrial feed. The majority of farmers (59%) feed twice a day. The average age at breeding is 6.55 months for gilts and 6.11 months for piglets. Litter size is 8.70 ± 1.34 piglets. Weaning is done at will at two months. Two farrowings per year and a low abortion rate (1.8%). They practice castration (30.76%). In terms of health, the majority (62.2%) treat their animals themselves. On the economic and commercial level, the gross margins are all positive and marketing is most often done during the holidays. Theft, feeding difficulties and problems related to the market for their products remain the major constraints that hinder the development of the pork sector in the commune of Fimela.*

Keywords— *Pig, farmer, breed, feeding, rambling, management.*

I. INTRODUCTION

Livestock in Senegal is a strategic sector that occupies nearly 60% of agricultural households. It represents 4.6% of the Gross Domestic Product and contributes nearly 0.2% to its growth, which stands at 4.3% (CEPSE/MEPA, 2015). Annual per capita meat consumption is 14.8 kg per year (PNDE, 2011) in Senegal, which is far below the world average of 42.2 kg and that of developed (76.1 kg) and developing countries (33.3 kg).

Pig farming provides income to farmers as a means of livelihood in tropical regions (FAO, 2012) and is well suited to fight poverty (Mopate et al., 2010). Indeed, the pig is a short-cycle species, with high prolificacy and capable of valorizing diets of various kinds.

Because of its ability to use alternative food resources and its high zootechnical potential, the pig represents a major asset for food security in the world in general and in Africa in particular.

Pork farming and its consumption are religiously connoted, as they are forbidden by the Muslim religion, which concerns 94% of Senegalese. Despite a population with a Muslim majority, the number of pigs in Senegal has increased from 354,474 in 2010 to 443,719 in 2020, an increase of 25.27%. Pork consumption will increase from 13,300 tons in 2010 to 18,547 tons in 2020, representing 6.5% of national meat production in 2020.

In Senegal, the pig herd is concentrated mainly in the regions of Ziguinchor, Fatick, Kaolack and Thiès.

The interest in pig farming has led to numerous studies throughout the world. In Senegal, studies aimed at diagnosing the sanitary and zootechnical aspects, marketing and the impact of garbage dumps on this type of farming have been conducted by Buldgen et al. (1994), Missohou et al. (2001), Le Glaumec (2006), Seck (2007), Lalèyê (2007), Sambou (2008), Bassene (2010), Doumana (2011), Fall et al. (2017), Fall (2017) and Fall et al. (2020).

However, the Senegalese pig farming system is dominated by extensive production based essentially on agricultural crop residues (Fall, 2017). This livestock production is subject to very large fluctuations, which are dependent on climatic changes and various epizootic diseases. Insufficient supplementation allows only the maintenance needs of the animals to be maintained during the rainy season. Feed deficiencies are responsible for zootechnical underperformance and mortalities throughout the year (Fall et al., 2017). Nimbona (2016) had reported that access to pig feed is difficult for farmers (90.22%), a reason that opens the door to raiding with huge economic losses. Feeding represents a worrying parameter for animal productions and particularly for pigs. The control of this parameter represents a major stake to optimize the genetic potential of the animals in most countries and particularly in Senegal where the breeding occupies an important place in the economy.

The objective of this work is to contribute to the production of knowledge on the pig industry in Senegal, where studies are quite rare. The aim is to characterize the socio-economic characteristics of farmers, identify the different types of livestock production and analyze the different constraints.

Abdou Khadre FALL, Thierry Daniel Tamsir NESSEIM, and Abdou Khadre NDIAYE, " Socio-technical Analysis of Pig (Sus Scrofa Domesticus, Linnaeus, 1758) Breeding in the Fimela Commune of the Fatick Region of Senegal," *International Research Journal of Advanced Engineering and Science*, Volume 7, Issue 3, pp. 172-177, 2022.

International Research Journal of Advanced Engineering and Science
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II. Material and Methods

2.1 Study Area

The district of Fimela, which has an area of 1,118.5 km^2, is located in the department of Fatick in Senegal. The geographic coordinates are 14°7'60" N and 16°40'0" W in DMS (degrees, minutes, seconds) or 14.1333 and -16.6667 (in decimal degrees). The UTM position is CA26 and the Joint Operation Graphics reference is ND28-05.

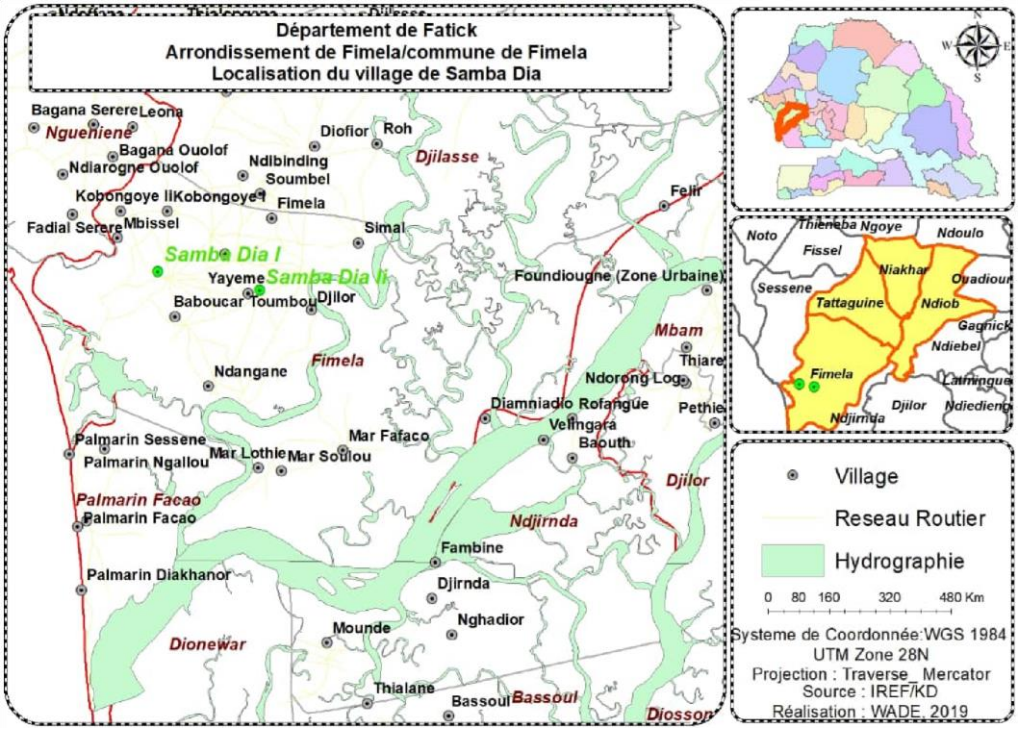

Fig. 1. Administrative map of the commune of Fimela (Fatick)

Source: IREF/DK, 2019

The ethnic groups that make up Fimela are: Serer (75%), Bambara (23%), Diola, Mandingo, Wolof and others (2%). Agriculture is the primary economic activity of the people of the Fimela district.

2.2 Study data collection and processing materials,

Several methods were combined. These included a literature review, formal and informal surveys, and data processing and analysis. Data collection was done through informal and formal surveys. The informal survey was based on observation of the environment and the practices of the herders. The informal survey was supplemented by discussions with farmers, livestock stakeholders, and bibliographic research. The formal survey was systematic. All identifiable and known herders were surveyed. There were 67 of them. A questionnaire was used to conduct the survey. The socio-economic characteristics of the most documented breeders are: gender, age, ethnicity, level of education, main and secondary activity, reason for breeding, duration of activity, origin of animals. The most documented zootechnical data are: breed, type of production, current number of animals, structure of the herd, mortality rate, sex ratio, pathologies encountered, reproduction management, feeding, workload, exploitation. The economic data of the farm to be identified were: the different expenses, the revenues and their destinations.

The collected data were processed with Microsoft Excel 2013 (matrix of counting) and analyzed by SPSS software (IBM SPSS Statistic 20 version). Descriptive analyses, pivot tables, calculation of averages, standard deviations, frequencies, minima, maxima and X2 tests of independence on pivot tables are done.

III. Results and Discussion

3.1 Results

3.1.1 Socio-economic characteristics of the farmers

The pig farmers are more women (67.9%) than men (32.1%) and are distributed in four of the 16 villages in Fimela. They are married (68%), widowed (14.1%), single (12.8%) and divorced (5.1%). The average age of the breeders is 46, 48 ± 12.98 years and ranges from 24 to 75 years. They are 93.6% Christian and 6.4% Muslim. The herders are all of the Serer ethnic group and have an illiteracy rate of 22%. The other herders have elementary (42.3%), middle (17.9%), secondary (6.4%), and higher (11.5%) education.

The main activity of the herders is largely dominated by trade (39.7%) and agriculture (24.4%). However, among them were workers (7.7%), housewives (7.7%), civil servants (6.4%), students (3.8%), market gardeners (3.8%), wrestlers (3.9%) and gardeners (1.3%). In this regard, pig breeding is a secondary activity (94.9%).

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However, women (32.05%) have received training in pig breeding, compared to only 11.53% of men.

The reasons that pushed the farmers to raise pigs are distributed as follows: income generation (76%), sale and self-consumption (19%) and habits and customs (5%).

The average length of time farmers have been raising pigs is 12.59 ± 8.97 years. However, some of them have been doing it for more than 40 years.

3.1.2. Technical characteristics

3.1.2.1 Breed, number of pigs, barns and equipment

The main breeds owned are the local breed (51.3%), mixed breeds (40%) and large-white (8.7%). There are 1301 pigs in Fimela (Table 1). Cochineal pigs are the most numerous in the piggeries (26.7%) followed by gilts (24.1%). The average herd size is 19.4 pigs.

TABLE 1. Structural characterization of pig herds

Category	Number	Average	Percentage
Sow	225	3,4	17,3
Boar	167	2,5	12,8
Pig	248	3,7	19,1
Gilt	313	4,7	24,1
Piglet	348	5,2	26,7
Total	1301	19,4	100,0

The dwellings are piggeries without roofs (64.1%) with roofs (11.5%) and 24.4% do not have any (figure 2).

Fig. 2. Example of a pigsty

The majority of farmers use cut plastic containers (70.1%) to feed or drink their animals (figure 3).

Fig. 3. Feeding trough and drinking trough in can and kitchen utensil

3.1.2.2 Breeding method and management

Stabling (46.2%) and semi-divagation (41%) remain the most common rearing methods in the commune of Fimela. Stabling (46.2%) and semi-divagation (41%) remain the most common breeding methods in the commune of Fimela. Uncontrolled breeding is estimated at 52.6%. However, 47.4% of the breeders make a controlled crossing.

The average piglet size per farrowing is 8.7 ± 1.34. The number of piglets per farrowing varies from 3 to 8 for the local breed, 5 to 10 for the mixed breed and 8 to 12 for the large-white. However, farmers claim to have two litters per year per sow. (26.92%) of the farmers say that the weaning age is about 2 months while the rest of the farmers (73.08%) seem to ignore it.

The average age at mating is 6.55 months for gilts and ranges from 5 to 7 months. The average age of service for piglets is 6.11 months and ranges from 6 to 7 months. However, the abortion rate is 1.3%.

3.1.2.3 Feed management, hygiene and health

Pigs are fed by a combination of kitchen scraps and industrial feed (81.8%). The 6.5% and 11.7% of farmers give kitchen scraps and industrial feed respectively. The breeders (59%) give the food in the morning and evening, the 18% at noon, the 12.8% in the evening and the 10.3% in the morning.

As far as hygiene is concerned, all the farmers regularly clean their water troughs, feeders and piggeries with family labour. However, medical assistance for pigs in the commune of Fimela is almost non-existent.

62.2% of farmers treat their animals themselves. Some seek the services of a traditional practitioner (20%) or a veterinarian (17.8%). Only 3.8% of farmers vaccinate their pigs against African swine fever. This low vaccination rate is due, according to the respondents, to the unavailability of a veterinarian (73.7%) and to the total absence of a vaccination park (26.3%).

However, in 2019, there was a very deadly contagious disease that affected pigs roaming in Mar Lothie Island. This disease was African Swine Fever (ASF) which had decimated 59% of the herd.

The most frequent symptoms in the municipality of Fimela, are distributed in the figure 4.

The main causes of death are diseases (53.1%), accidents (16.7%), rain (15.8%), heat (8.8%) and intoxication (6.1%).

3.2 Discussion

3.2.1. Socio-economic characteristics of the farmers

The study showed that the proportion of female pig owners, estimated at 67.9%, is much higher than that of male owners (32.1%). This difference can be explained by the fact that women have more time and men are not more interested in pig farming. They do it as a secondary activity. This result is different from that obtained in West and Central Africa, where the practice of pig farming is taken up by men (Ayssiwede, 2004; Ndebi et al., 2009; Umutoni, 2012). However, in the Mbeubeuss area (Dakar, Senegal) women are strongly present and represent 78.9%, according to Sambou (2008). The same is true in Ziguinchor where they make up 57% (Sambou, 2018). The results obtained in the commune of Fimela are higher than those obtained in the commune of Thiès (Fall et al., 2017) where women represent 49.07% and in the commune of Bambey (Mbengue 2018), with a value of 53% for women.

The average age is 46, 48 ± 12.98 years and the majority of herders are married. It is an activity that interests very little young people. This average age is slightly lower than that obtained in the commune of Thiès 49.85y ± 10.85 (Fall et al.,

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2017) and is roughly equivalent to that found in the commune of Bambey 45y (Mbengue 2018).

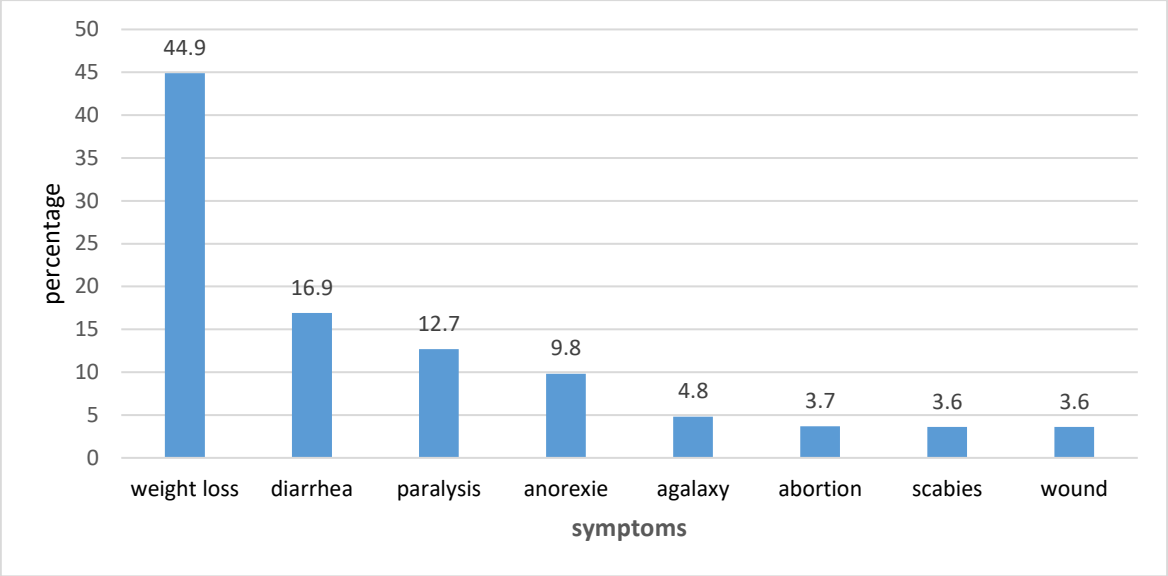

Fig. 4. different diseases

The set of breeders are all Serer. This result is due to the historically uneven distribution of ethnicities across regions of the country. These results are inconsistent with those obtained in Senegal by Buldgen et al. (1994) and Sambou (2008). The latter reported that 87% of pig farmers in the groundnut basin belong to the Serer ethnic group and 86.7% to the Sérère ethnic group.

Pig farming is practiced by Christians who represent the majority (93.6%) and Muslims (6.4%) who reside in the village of Djilor. The Muslims raise pigs only for marketing and not for consumption. This result does not appear to be unique, as in Bobo Dioulasso, Burkina Faso, where Kiendrebogo et al., 2008 report that there are Muslims (4-6%). However, the results obtained in the commune of Bambey are not similar to our results because all pig farmers are Catholics.

Pig farming is considered a secondary activity (94.9%). Trade is still the main activity with 39.7%. However, Ndebi et al, 2009 confirm that in several West African cities, 64% of pig farmers are farmers.

The low illiteracy rate is explained by the fact that the farmers live near a high school that is located in the center of these villages. The majority of respondents spent their childhood in large cities such as Dakar, Mbour, and Joal where access to education is easy. These results are different from those found in the commune of Thiès (Fall et al., 2017) and the commune of Bambey (Mbengue (2018)). But, they are similar to those of Houndonougho et al., 2012, Ndebi et al (2009) respectively in Southeast Benin (67%) and Cameroon (74%).

The average duration of rearing is 12.59 ± 8.97 years and varies between 2 and 40 years. It is contrary to that found in the commune of Thies Fall et al., 2017, in Cameroon by Houndonougho et al., 2012 and in N'Djamena by Mopate et al., 2011). However, this trade has long been practiced by the Sereres for about 40 years. This explains the concrete experience of the herders.

3.2.2 Technical characteristics

The average number of pigs per farm is 12 ± 9.04 per farm. This average is roughly equivalent to that of Missohou et *al*., 2001 in Basse Casamance (11 ± 9.1). This size is strongly influenced by the number of sows owned and the absence of customers. However, these results are lower than those found in the commune of Thiès (Fall et *al*., 2017), Sambou (2008) in Dakar (20.8 subjects) and Mopaté et *al*., 2011 find that in NDjaména in Chad, the average size of a farm can vary from 13.7± 10.2 to 19.27± 14.55 pigs. This difference can be explained by the lack of means of the breeders, which leads some of them to sell or to self-consume their animals.

The breeds present in the commune of Fimela are the local breed, the mixed breed and the large-white breed. The local breed is the most exploited compared to the mixed breeds and the exotics. Breeders choose these animals because of their low purchase price and high adaptability. These results are similar to those found by Missohou et *al* (2001) who showed that in Lower Casamance the local breed occupies 66.7% of the pig population. The presence of the mixed breed is due to the policy of breeders to improve the local breed.

The different types of livestock production recorded in the commune of Fimela are free-range, semi-free-range, and stabling. Roaming and semi-divagation are due to lack of food. These results are contrary to those found in the commune of Thiès Fall et *al*. (2017), who showed that rambling and semi-divagation are explained by the lack of space and or strong pressure from local residents who do not tolerate the nuisance (odors) caused by the pigs. This form of divagation often leads to many problems. Indeed, in the island of Mar Lothie in 2019, a contagious and very deadly disease had affected the pigs in divagation. These results are comparable to those noted in

Abdou Khadre FALL, Thierry Daniel Tamsir NESSEIM, and Abdou Khadre NDIAYE, " Socio-technical Analysis of Pig (Sus Scrofa Domesticus, Linnaeus, 1758) Breeding in the Fimela Commune of the Fatick Region of Senegal," *International Research Journal of Advanced Engineering and Science*, Volume 7, Issue 3, pp. 172-177, 2022.

southern Chad and northern Cameroon, according to Phorpyre (2009), however, stray animals pose many problems, particularly in terms of the control of animal diseases, the transmission of diseases dangerous to humans, the destruction of crops or accidents that the animals may cause.

The housing is in pens (59%), improved traditional piggeries without roofs (11.5%) and piggeries with roofs (5.1%). The results are comparable to those reported by Mopate et al. 2009 and Ndebi et al. 2009 in Central Africa. However, they differ from other work conducted in Senegal (Sambou, 2008; Bassene, 2010; Doumana, 2011), Benin (Ayssiwede, 2004) and Burkina Faso (Umutoni, 2012), all of which found that improved or semi-modern buildings were in the majority. This difference is explained by the location of the farms surveyed. Farms in the peri-urban areas of the main economic centers are most often improved.

The average age at breeding for piglets and gilts and the average age per litter were 6.11 months, 6.55 months and 8.70 ± 1.34 piglets respectively. The results are contrary to those found in Central Africa (Abdallah, 1997), Chad (Mopate et *al*., 2009), Senegal (Missohou et al, 2001; ISRA, 2003; Sambou, 2008), Benin (Ayssiwede, 2004) and Côte d'Ivoire (Tra bi tra, 2009). The observed difference can be explained by the difference in the level of development and practices of pig farming.

Weaning is most often done by the will of the sow between about 2 months according to 26.92% of respondents and 73.08% do not know the weaning age of their sows. In fact, weaning is stopped without human intervention. However, the results are similar to those of Umutoni (2012) in Burkina Faso (66.5 days), FAO (2012) in the Democratic Republic of Congo (6 weeks) and Ayssiwede (2004) in Benin (2.16 months) because of the traditional system that is in the majority in our study compared to those of these authors. Castration is practiced by a minority (30.76%) between 3 and 4 months. These results are consistent with those obtained in Benin by Ayssiwede (2004) and in Senegal by Buldgen et *al*. (1994), which are respectively 3.64 months and 4 to 5 months.

Farmers mainly feed their pigs with kitchen scraps, meal scraps, mangoes, industrial feed and grass during the winter. The majority of farms surveyed use industrial feed. Indeed, kitchen and meal scraps are becoming increasingly rare. Nevertheless, the results obtained in Côte d'Ivoire (Tra bi tra, 2009), Benin (Ayssiwede, 2004) and Thiès Fall et *al*. (2017) differ from ours. The first two state that more than 90% of farmers use feedstuffs to feed their pigs and the last confirms that the consumption of concentrated feed and agri-food by-products is quite low because of the low investment of farmers and the fact that they are not in a semi-intensive or intensive system. This difference can be explained by the level of development of the pig industry in each country.

Veterinary monitoring of pigs in the commune of Fimela is almost non-existent. A total absence of sanitary and medical prophylaxis campaigns. The majority (62.2%) treat their animals with traditional products themselves. 3.8% of respondents only vaccinate their animals once a year. These figures are, however, very different from those of Ayssiwede (2004) in Benin, where 54.5% of pig farmers have updated prophylactic measures to protect their farms against infectious diseases, and Missohou et al. (2001) found that vaccination coverage is 25% in villages and 43.7% in urban areas in Lower Casamance. This can be explained by the unavailability of veterinarians and the absence of vaccination and prophylaxis campaigns.

IV. Conclusion

Pig farming in the commune of Fimela remains an important sub-sector in the diversification of food and cash resources. It is an activity that interests women more than men. The breeders are all from the Serer ethnic group and are mostly educated. Nearly 24.4% of herders combine herding with agriculture. The majority of them are Catholics and the majority are married.

The majority of pigs are kept in pens without roofs. The breeding systems are free-range, semi-free-range and total stalling, and the breeds raised are the local breed, the large-white and the mixed breed. The pigs that roam feed on garbage dumps and in houses, while the pigs that are kept in stalls feed on industrial feed and leftovers from meals and cooking.

In terms of sanitation, the majority of farmers treat their animals themselves with traditional products. Almost all farmers do not vaccinate their pigs and there is a total absence of deworming of pigs.

The average number of pigs per farm is 12 ± 9.04 and the average litter size is 8.70 ± 1.34 piglets. Almost half of the farmers control the reproduction and weaning age of the piglets is 2 months.

The marketing of pigs is most often done at Christmas, Assumption and Easter. Revenues are used to meet needs, including feed and schooling. Annual gross margins are positive. Nevertheless, feed costs are the main factor in the profitability of pig farming.

However, the main problems hindering the development of pig production in the commune of Fimela remain theft and food difficulties and problems related to the market for their products. But the farmers had problems with customers to sell their pigs.

To renew the activity of pig breeding which provides a living for thousands of people in Senegal in general and in the commune of Fimela in particular and to place it in a context of sustainable development.

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Abdou Khadre FALL, Thierry Daniel Tamsir NESSEIM, and Abdou Khadre NDIAYE, " Socio-technical Analysis of Pig (Sus Scrofa Domesticus, Linnaeus, 1758) Breeding in the Fimela Commune of the Fatick Region of Senegal," *International Research Journal of Advanced Engineering and Science*, Volume 7, Issue 3, pp. 172-177, 2022.

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