

Characterization of Pig Culture (*Sus Domesticus*) and Its Economic Impact in the Province of Maniema in the DRC (Case of the City of Kindu)

Christophe Myonge Lukusa¹, Musa Pondamali², Bya'ombe Balongelwa De-Dieu³, Bondombe Wa Yalokombe⁴ And Jean Pierre Mukandama Ndolandola⁵

¹Faculty of Agricultural Sciences at Kindu University

²Higher Pedagogical Institute of Kisangani/Exact Sciences section

³Kindu Higher Institute of Rural Development

⁴Faculty of Agricultural Sciences of IFA-YANGAMBI/Kisangani

ARTICLE INFO

Article history:

Received: 2 February 2024;

Received in revised form:

6 March 2024;

Accepted: 16 March 2024;

Keywords

Pig,
Breeders,
Technical Evaluation,
Profitability.

ABSTRACT

The objective of this work is to provide breeders in the pig industry with technical and economic data that can be used for the proper functioning of a piggery. This is an analysis of pig production in the Province of Maniema in general, more precisely in the town of Kindu. The methodology uses surveys (transversal and retrospective) among producers targeting the profile of breeders, their practices, zootechnical and socio-economic performances. The majority of breeders are Catholic Christians, most of whom are employed and practice breeding as a secondary activity. They are 90% men. The pigsties are either semi-modern (6/10) or modern (4/10). The food is based on rice bran and corn flour which are used by all breeders. Fish meal is used by 80% of breeders and cassava by 70%. Large White pigs dominate the different farms. The average herd is 86 pigs. The age at first farrowing varies between 11 to 14 months and the average number of farrowings per year is two. The average numerical productivity per female per farrowing is 10 piglets. The age at weaning varies between 45 and 90 days. The dominant pathologies remain external parasitoses and digestive diseases causing diarrhea. These pathologies are present in all the farms visited. The farms display an average annual gross profit between 40 and 60 pigs/year depending on their size, based on 3600 FC/kg or 2.1 \$ dollars per carcass. Once we can estimate that the farm generates a result of 2,400 \$ to \$3,600 dollars per year or \$ 200 to \$ 300 dollars per month in income for the family. Young sows are put into breeding at 10 or 12 months when their weight reaches 80 or 100 kg live weight. Litter size is 8-12 piglets born alive and 6-8 piglets are weaned on average. Females are mated on average two to three times during heat, until the sow refuses mating. Future breeders are sold at \$ 40 to \$ 70 for piglets 2 to 3 months old. Breeders sell their pigs to commission agents who act on their behalf and make group purchases from breeders before proceeding with slaughter. The slaughter and consumption of pigs is also done locally. The animals are purchased at a price of 3,600 FC per kg of carcass. Slaughtering takes place at the slaughterhouse after payment of a tax of 1,500 FC. Once the animals have been slaughtered, skinned and inspected, the carcass is then transported on the back of a cart or on a motorcycle taxi to be sold at the Kindu central market at a price of 4,500 FC to 5,000 FC/kg. The roasters, for their part, offer meat skewers or pieces of cooked pork to consumers at prices ranging from 1000 FC per skewer at the restaurant bar and 1000 FC or 2000 FC per piece of meat. This study shows that pig farming is a very profitable activity as long as it is well managed. The constraints remain linked to management, the quality of production and processing. Improvement strategies should focus on the organization, accountability and supervision of stakeholders for better management of production in the interest of the development of this breeding.

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1. Introduction

1.1. Context of the Study and Choice of Subject

“We will not be able to meet the current needs of pig farmers without seeing the blockages in the characterization of pig farms in the town of Kindu to meet the needs of pig farmers”, this is the backdrop to the concept of sustainable

development which implies a broader vision of pig farming. Pork has enormous potential (short reproduction and production cycle, high food conversion and good adaptation to different ecosystems) which has enabled certain African countries and even the cities of the DRC to meet meat needs (FAO, 2006). The pig is resolutely positioned as an animal of

Tele:

E-mail address: christophemyonge@gmail.com

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choice in the policy of developing pig farming in the town of Kindu. However, the pork sector faces different challenges in order to develop. According to (Muys, 2003), the inadequacy of sanitary conditions, poor practices in pig farming, as well as the absence of veterinary services (insufficiency of the distribution network for veterinary products, limited number of technicians, etc.) are all factors that lead to real public, animal and environmental health problems. Pork production constitutes for the farmer an important savings for the resolution of social problems (schooling, marriage, funerals,) etc., this will make it possible to develop appropriate strategies for the development of the sector, with a view to achieving sustainable production. This is why the choice to characterize pig farming in the town of Kindu, where enormous activity in the sector was noted, which can serve as a basic model of development in several households in the area.

1.2. Problematic

In developing countries, land occupation for agriculture or urbanization considerably reduces grazing areas for ruminants. These limits highlight the place of pork, often neglected even though it is the most consumed animal in the world (CIRAD, 2007). Pig farming, through the multiple advantages it offers compared to other farmed animals, is ideal for helping to combat poverty. Pig is a prolific animal, producing seven to eight times more meat than beef per year per tonne of live animals in Africa (Bathily, 1975). Pig breeding constitutes one of the important sources of protein and a secondary activity for several socio-professional categories, to whom it provides additional income (Missohou, 2001; Mopaté, 2010; Ndeby, 2009; FAO, 2012a; FAO, 2012b). It thus represents a major asset for the fight against food insecurity and improving the income of populations, particularly in Africa where demographic pressure is increasingly strong. Pig farming is a real social shock absorber, first of all thanks to the numerous job opportunities generated by the sector, but also thanks to the constant flow of income from sales. This allows herder households to meet their vital needs and thus improve their daily lives (Mormede, 2018). As reported by Mopaté and Koussou (2003), the establishment of a pig farm is most often motivated by the desire of the producer to carry out a project and adopt a strategy of diversification of production to fight against poverty. Over the last two decades, the deep socio-economic crisis experienced by the DRC in general and Maniema in particular, associated with repeated civil wars, looting, epidemics and other disasters have undermined the Congolese agropastoral sector and caused the fall in livestock production (Simba, 2017). According to Fabre (2018), to meet the needs for proteins of animal origin of the Congolese population in general and that of Maniema in particular: it is necessary to take advantage of zootechnical aspects that can influence animal welfare by pig farmers in order to give meaning to this activity. In Maniema and more precisely in Kindu, the pork meat trade is an activity carried out by women who, for the most part, ensure the food security of households through the sale of poultry, for example, which constitutes one of the pillars of the food security strategy (Simba and Jelu, 2015). Currently, given the advantages that pig farming presents (fertility, prolificacy, fertility and its rapid growth) we are seeing an enthusiasm among women for this commercial activity, in order to provide for the multiple needs of their families (school fees, health care primary, etc.) (Sheria, 2003). Unfortunately, the lack of mastery of appropriate techniques that could enable them to make this breeding more

profitable is dampening the enthusiasm of these actors. Thus, we were interested in undertaking this study in order to evaluate the zootechnical and economic characterization in Maniema (Kindu) with a view to its improvement.

1.3. Research Questions

As part of this study, we address the general question of: "What is the characterization of pig farming and its economic impact in the City of Kindu?" » From this general question, four specific questions were formulated: - What are the socio-professional profiles of pig farmers in Kindu City? - What are the zootechnical parameters that contribute to characterizing pig farming? - What is the economic impact of pig farming in the City of Kindu? - What strategies should be considered for improving pig farming?

1.4. Hypotheses

The general hypothesis of this study is formulated as follows: the characterization of pig farming is in the traditional system and its economic impact is positive. The specific assumptions are as follows: - The socio-professional profiles of Kindu pig farmers are characterized by civil servants; traders; Breeders; and the private sector - The zootechnical parameters are characterized by the breeding of the traditional system at the level of pig farmers; - The economic impact of pig farming is positive; - The analysis of MOFF (Threats; Opportunities; Strengths and Weaknesses (tools for analyzing strategies as a diagnostic phase) makes it possible to consider the strategy for improving pig farming.

1.5. Objectives of the Study

1.5.1. Main Objective

The overall objective of this study is to characterize the zootechnical parameters and assess the economic impact of pig farming in the City of Kindu.

1.5.2. Specific Objectives

Given the particularity of this study, we set ourselves the following specific objectives:- Identify lifestyles on the socio-professional profiles of pig farmers;-Characterize zootechnical parameters including housing, reproduction, feeding, health and technical management of pig farming;- Determine the economic indicators of pig farming; - Propose strategies for improving pig farming in the City of Kindu.

1.6. Interest of Work

This study is of double interest: scientific and economic. On a scientific level: this study presents knowledge of zootechnical and economic characteristics for the improvement of pig farming. From a practical point of view: this work makes it possible to establish or develop a strategy for improving pig farming in relation to its very rapid growth and prolificacy.

1.7. Spatio-Temporal Delimitation

The data collection for this study took place in the town of Kindu (Maniema Province in the DRC) from October 5, 2017 to April 3, 2019.

1.8. Subdivision of Work

Apart from the introduction, the present work is subdivided into four chapters namely: - The first chapter deals with generalities on pig breeding; - The second relates to the environment, materials and methods; - The third presents and interprets the results; - And the fourth concerns the discussion of the results A conclusion and some recommendations end our investigation.

Definition of the MOFF technique MOFF analysis: (Threats, Opportunities, Strengths and Weaknesses) is a method of analyzing the strategic context. It makes it possible to identify the internal strengths and weaknesses of an entity, its opportunities for development as well as the threats likely

to affect its reason for being or compromise the achievement of its objectives. Use: MOFF analysis is used to build a project and to review an entity's strategy.

2.1. Study Environment

This chapter is structured around three sections, namely: the study environment focused on the geographical and administrative location of the city of Kindu. The experimental site for data collection was located in the town of Kindu, particularly in the Mikelenge commune, Kasuku and Alunguli, following our availability in the area.

2.1.1. Presentation of the City of Kindu

2.1.1.1. Geographical Framework

The town of Kindu is bounded:

- in the North, a vertical straight line going from the Misubu river on the right bank, passing through Keka village downstream of the Congo river, towards the left bank of the Congo river in the North – left of the Kindu airport runway up to its intersection with the Kindu – Lokando road near the Lwama cemeteries;
- to the South, a straight line starting from the source of the Mikonde River to its mouth upstream of the Congo River, going from the right bank to the left bank at the mouth of the Mukolochi River passing by Rail road until at the Kibombo road crossing;
- to the East, a straight line starting from the source of the Mikonde River to its intersection going to the right of the Misubu River bridge;
- to the West, by a straight line which starts from the Lokando crossing, only from Lwama passing by the Mikelenge river bridge on the Katako – Kombe road to the Kibombo road.

The town of Kindu is made up of three communes, one of which is on the right bank, that of Alunguli, and two others on the left bank. These are Mikelenge and Kasuku. It extends over an area of 101,259 km² and with an altitude of 487 m, i.e. 25°47' East longitude and 2°47' South latitude. (Morel, 2007).

a) Municipality of Kasuku

Entirely located on the left bank of the Congo River, Kasuku is an urban commune. It is limited to the north by the Bangengele chiefdom in Kailo territory, to the west and south by the Kapondjo and Mikelenge rivers which separate it from the commune of Mikelenge, to the east by the Congo river formerly (Lualaba) which separates it from the commune of Alunguli. It is the main commune of the town of Kindu, due to its central geographical position and especially the concentration of socio-professional activities and public infrastructures. The governorate offices, the provincial government as well as the City Hall are located in this commune. (Figure 1)

b) Municipality of Mikelenge

Entirely located on the left bank of the Congo River, Mikelenge is an urban-rural commune. It is limited to the north by the Lwama road; to the east by the Kapondjo, Mikelenge and Lualaba rivers; to the South by the village Libenga; to the west by kilometer point 10, Mikelenge houses the headquarters of the Provincial Assembly of Maniema. (Figure 1)

c) Municipality of Alunguli

Entirely located on the right bank of the Congo River, Alunguli is an urban-rural commune (figure 1). It opens the city to the mining sites in the east (Kailo, Kalima, etc.) and the Kasongo Territory to the south. Its population is made up of more than three quarters by the Lega, the rest being made

up of the Genya (falsely called here Lokele), followed by the Songola (N'sanda, 2011).

2.1.1.2. Biophysical Framework

a) Soil and relief

The relief is that which characterizes the end of the central Congolese basin, very uneven with the soil which varies between the clay-sandy and sandy-clay type. This region has agricultural soil which allows the cultivation of all kinds of crops, both food and cash (Yuma, 2016)

b) Climate and vegetation

According to the meteorological service and according to the KÖPPEN classification, the city of Kindu is characterized by a hot and humid climate which evolves from the equatorial type to the North. The average temperature is around 25 to 27°C and precipitation amounts to 1650 mm.

The climate is characterized by:

A rainy season which occurs twice a year: from August to December and from January to mid-May.

A dry season which does not exceed 4 months, which goes from mid-May to mid-August, accompanied by fog during the morning and disparate fine rains.

Season A normally begins in mid-September until January and season B begins in February until May. Thus, the climatic data from our work are presented in the table below:

The primary vegetation of this city having been destroyed for a long time, it contained valuable species in particular: *Chlorophora excelsa*, *Entadrophragmaborea*, and others which have now given way to grasses and legumes, shrubs and shrubs. Among them, we cite *Musangacecropioides*, *Eupatorium odoratum*, *Hyparrheniasp*, *Pueraria javanica*, *Elaeis sp*, etc. (Yuma, 2016).

c) Hydrography

It is essentially composed of the Congo River and its tributaries located on either side of the said river. On the right bank, there are the following tributaries: Kindu, Kange, Mikonde, Luambondo, Muchondo, Mangobo, Kamikunga and Musubu. On the left bank we have: Mikelenge, Luandoko, Makopo, Canals. (Yuma, Op cit).

2.1.1.3. Population

The estimated size of the population is 453,941 inhabitants, according to demographic forecasts established with reference to data provided by the three municipalities of the city and on the basis of an average rate of change in the population observed during the period of 2018.

As for religion, 4 large groups dominate the city: Catholics, Muslims, Protestants and those from revival churches. Believers in revival churches are growing sharply in the city. (City Hall, 2019)

2.1.1.4. Socio-Economic Situation

According to (Yuma, 2016), the town of Kindu is essentially agricultural. Some Kindu residents farm on the outskirts of the town to meet their needs. The food crops generally grown are: Rice, Corn, Cassava, Banana, etc. It is also grown in a small proportion of perennial crops (robusta coffee and oil palm).

Regarding livestock, the population of Kindu traditionally practices the breeding of small livestock (pig, goat, rabbit, sheep, guinea pig) and the breeding of poultry (chicken, duck, pigeon, didon, guinea fowl. Fish farming is also practiced there.

Generally, the city's state-owned enterprises are old; this is particularly the case of: REGIDESO (Water Distribution Authority); SNEL (National Electricity Company); the SNCC (National Railway Company of Congo); O.R (Road Office) etc. (Onadambo, 2015).

2.2. Material Used

As part of this study, two types of materials were used, namely: biotic material and abiotic material.

2.2.1. Biotic Material

To achieve our objectives, the biotic materials consist of pigs which are present in the City of Kindu.

2.2.2. Abiotic Material

To collect the data, we used the following abiotic materials: the motorcycle; the notebook; the pen; computer and digital camera

2.3. Methods

Any research or application of a scientific nature in general must include the use of rigorous, defined, transmissible processes, capable of being applied again under the same conditions, adapted to the type of problems and phenomena in question (Pinto and Grawitz, 1971)

The method adopted here is part of an approach characterizing the pork sector. For this, we were inspired by the work carried out by other researchers from production to sale. The work uses participatory and empirical methods, which are supported by documentation techniques and then the collection of data in the field.

2.3.1. Pre-Investigation

This phase made it possible to contact the various pig farmers, state services and traders operating in the town of Kindu. During this stage, we used sampling which was dictated by the sole criterion of accessibility. This is how the interview with the leaders of the sector took place when they were available. The pre-survey provided an idea of pig farming and constituted a basic tool for the formulation of the work, the development of the survey questionnaire and the interview guide. It took place from September 10 to November 4, 2017.

2.3.2. Participatory Observation

For this research, data was collected from the different supervisory offices in relation to the field of this pig activity, such as the Provincial Inspectorate of Agriculture, Fisheries and Livestock and the Provincial Division of the Environment.

The participatory method made it possible to obtain their points of view on pig farming from state services.

2.3.3. Empirical Method

The moments of observation were used for the benefit of the researcher to verify the statements of the respondents. This offered the possibility of describing certain salient facts, also we formulated criticisms with regard to the information obtained and we had matured reflections (Pinto and Grawitz, 1971).

2.4. Techniques

To carry out this work, free interview techniques supported by a survey questionnaire, documentary technique, direct observations and focus group were used.

2.4.1. Interviews and Field Interviews

The organization of interviews with the people surveyed in our study environments using survey questionnaires (Figure 3) to obtain the data was done. The people interviewed are chosen based on their expertise.

2.4.2. Documentation

We had consulted certain works, reports from services and scientific work relating to pig farming to improve the work.

2.4.3. Focus Group

The focus group was used to understand the needs and feelings of a group of people. For the dynamics of the group, it must be composed of 6 to 10 people, and the discussion

must take place for a period of more or less two (2) hours under the direction of a moderator (Trefon, 2008).

Its advantage lies in reducing the cost of acquiring information and its disadvantage is that there is a big gap between what is said and what is actually done by the population on the ground (Trefon, Op cit).

We used this technique to bring together a small group of pig farmers concerned by our research (5 people per municipality) with whom we had discussed the theme of the study.

2.4.4. Direct Observation

It consisted of personally inquiring about the realities of research in different corners of the study environment (Yuma, 2016).

To collect the data, we moved to direct and experimental observation (figure 4) on how pig farmers carry out their activities in the town of Kindu.

This experience gives the chance to make a careful observation of the facts taking place in these study environments, relating to pig farming, and to see the diagnoses to find solutions to the problems found.

2.5. Data Collection

Data collection in the field was carried out from March 2018 to October 2019. The data was collected using survey sheets specifically designed for each socio-professional category. This data collection was carried out by organizing interviews during which we completed the forms. Therefore, the sampling unit is the household of farmers and traders at the study sites.

2.5.1. Determination of the Sample and Respondent Selection Criteria

The sample consists of thirty (30) pigsties selected as part of this study. The pigsties were chosen based on the following criteria:

- be among one of the sites selected after the pre-survey;
- be responsible for a pigsty living in one of three communes: Mikelenge, Kasuku and Alunguli.
- have at least ten pigs;
- easy accessibility to the pigsty.
- Interviews with farm managers to collect targeted information, structured according to a predetermined questionnaire because it was designed as a not completely open survey;
- Direct observations within the farm.

The information collected using the questionnaire concerned the status and activity of the breeder, the breeding system, the animals' habitat, the size and composition of the herd, pig feeding, reproduction, growth performance, prophylaxis as well as economic parameters. This data collection was carried out by organizing interviews during which the forms were completed. Therefore, the sampling unit was the farming household at the study sites.

2.5.2. Data Processing and Statistical Analyses

Data processing: based on the variables assessed below; the data was manually analyzed, entered, processed with Excel (scatter graph, diagrams and histograms)

1. Statistical analyses: economic characterization of pigs at different piggeries

Factorial and Cluster Analysis were used for the spatial characterization and classification of pigsties using the "STAGRAPHICS Plus – untitledstatFolio" software.

– Zootechnical data:

Boars: (Number of males per pigsty)

Sows: (Number of females per pigsty)

Piglets under their mother: (The size of the suckling babies)

Weaned piglets: (Number of young for distribution of the starter ration)

Pigs in fattening: (Number of young people in fattening until finishing)

Age at weaning: (Weaning period/days of pups)

Age at castration: (Period/Days of castration of pett mals)

Age of 1st birth/Female: (Period/month of the 1st birth of the female)

Number of births/female (year): (How many births/year of the female)

Number of deaths at birth: (Number of infant mortality during birth)

Litter size at birth: (Number of piglets farrowed by the female)

Economic variables:

1. Profit (\$) = production value (\$) - overall cost of production

Production value: (Purchase of breeding stock (\$) including sows and boars)

Production Value = Number of piglets x Sales or unit price

Production cost: (Breeder feed (\$/year), Ration transport cost (\$/year), Veterinary costs (\$/year) and labor (\$/year)

$$\text{Financial profitability}(\$) = \frac{\text{BENEFIT}}{\text{TOTALCOST.OR.OVERALL}} \times 100 \quad (1)$$

$$\text{Commercial profitability}(\%) = \frac{\text{BENEFIT}}{\text{TURNOVER}} \times 100 \quad (2)$$

3. Presentation and Interpretation of Results

This chapter essentially focuses on the results obtained as part of the present study in order to answer the questions formulated and/or verify the hypotheses. The data collected in the field in the form of information from the respondents were analyzed and processed using statistical analyses. To make it easier to understand. (This chapter is structured around zootechnical and economic results).

Characterization of pig breeding in the City of Kindu

Contribution of factors on the zootechnical variability of pigsties Table 1 below: indicates the contribution of two factors (FI and F II) and the total variance observed between the pigsties analyzed based on zootechnical characteristics estimated with the contribution of 47.30%. FI explains a variance of 31.50% and it is mainly characterized by: weaned piglets, fattening pigs, the age of first farrowing (female) and the number of litter at birth is the positive factor. Compared to FII explains a variance of (15.50%) is determined negatively and positively by the number of deaths at birth and the age at weaning respectively positive. The positive sign indicates that we go from negative to the zootechnical characteristics of the pigsties considered, while the negative sign indicates the opposite. The specific representation (figure 1) demonstrates the spatial distribution of the 30 pigsties, where we observe on the basis of table 1 that the pigsties located in boxes 1 and 4 according to factor 1 present higher values in weaned piglets, fattening pigs, the age of first birth (female) and the number of litters at birth. Compared to the pigsties located in boxes 2 and 3. Depending on FII, piggeries located in frames 1 and 2 have superior behavior for age at weaning and the number of birth deaths, while in frames 3 and 4 are the best.

Figure 1 shows the grouping of pigsties taking into account its spatial distribution (Figure 2), where three groups were formed.

Taking into account the classification of pigsties, we observe in Figures 2 three groups of pigsties according to zootechnical variables, the first class of which is made up of: (1,4,20,28,7,11,22,) with 23, 33%; the second class is made up of: (2,18,29,12,13,14,19,21,25) with 30% finally the last class is (3,6,16,24,27,5,10, 15,17,23,8,30,26 and 9) with 46.67%. The two factors contributed 47.3% to the average values of the variables considered per class trained in total.

The first factor, the average, is mainly characterized by weaned piglets (classes: 1=34, 2=11 and 3=8), fattening pigs (classes: 1=47, 2=27,3=6), age of first birth/female (classes: 1=12, 2=11,3=10) and number of litters at birth (classes: 1=10, 2=8,3=8).

In relation to the second factor, the average is characterized both by: age at weaning (classes: 1= 22, 2=46.3=19) and the number of deaths at birth (classes: 1= 2, 2=1 .3=1)

Economic characterization

Pig marketing circuit.

Based on the main customers of pork producers, Figure 34 shows how resellers occupy the most important place in the demand chain for this meat compared to restaurateurs, butchers, charcutiers and consumers even though these The latter constitute the terminal actors in the circuit below:

Contribution of factors on the economic variability of pigsties.

Table 4 below: indicates the contribution of two factors (FI and F II) and the total variance observed between the piggeries analyzed on the basis of piggeries operated for 15 months in relation to the economic variables estimated with the contribution of 99.99% .

Factor I explains a variance of (91.61%) these pigsties have a very low yield on (Profit per piglet -0.98 and profitability -0.98) therefore the factor is negative.

Compared to factor II explains a variance of (8.38%) is determined by the pigsties which present a good economic aspect compared to (Profit per piglet 0.41 as well as profitability 0.19) profitability is positive.

The positive sign indicates the economic characteristics of the pigsties operated for 15 months are considered, while the negative sign indicates the opposite or are not considered.

The specific representation (figure 4) demonstrates the spatial distribution of the 30 pigsties, where we observe on the basis of table 4 that the pigsties located in boxes 1 and 2 according to factor I present a higher economic value of profit/production cost, but poor economic values for the profit per piglet and a loss of profitability. And this compared to the pigsties located in frames 3.

Figure 4. Shows the grouping of pigsties taking into account its spatial distribution (Figure 4), where four groups were formed

Compared to the classification of pigsties above, we observe in Figures 5 four groups of pigsties according to economic variable, the first class of which is made up of: (1,2,11,20, and 22) with 16.67 %; the second class is formed of: (3,5,6,9,19,27 and 21) with (23.33%); the third class is (4,7,12,13,25, and 29) with 20% and the last class with 40% as pigsties (8,10,14,15,16,17,18,23,24, 26,28, and 30)

The two factors contributed 99.99% to the average values of the variables considered per class trained in total.

The first factor the average is characterized mainly by the profit or loss (1=12.59), (2=-81.33), (3=-4.38) and (4=-

25.11), Profit/ production cost (1=0.34), (2=-0.60), (3=-0.12) and (4=-0.32).

The second factor in relation to profitability the average is: (1=25.18), (2=-122.66), (3=-10.20) and (4=-50.22)

Table 6 below: indicates the contribution of two factors (FI and F II) and the total variance observed between the pigsties analyzed on the basis of pigsties operated for 6 months in relation to the economic variables estimated with the contribution of 99.98%.

The FI explains a variance of (97.46%) is mainly characterized by the pigsties (18 and others) presenting a good yield (Profit per piglet 0.99 as well as profitability 0.99) compared to the other pigsties which present a way of profit and profitability

Compared to FII explains a variance of (2.52%) is determined by the pigsties: (19,8,6,13) present a poor performance on the economic aspect compared to (Profit per production cost)

The positive sign indicates the economic characteristics of the pigsties operated for 6 months are considered, while the negative sign indicates the opposite or are not considered

The specific representation (figure 6) demonstrates the spatial distribution of the 30 pigsties, where we observe on the basis of table 13 that the pigsties located in boxes 1 and 2 according to factor 1 present a higher economic value of profit per piglet as well as profitability. And this in relation to the pigsties located in boxes 3 and 4.

Depending on FII, pigsties located in frames 2 have an economic value of profit and profitability, compared to frames 3 and 4.

Figure 7 shows the grouping of pigsties taking into account its spatial distribution (Figure 7), where four groups were formed.

Taking into account table 11 below which shows the classification of pigsties: we observe in figures 19 four groups of pigsties according to economic variables, the first class of which is made up of: (1,2,3,7,8,9,10,11,14,15,16,17,20,21,22,26, and 30) with 53.33%; the second class is made up of: (4,5,12,18,25,27,29) with 23.33%; the third class is (6,8,13,23,24,28) with 20% and the last class with 19% pigsty (19)

The two factors contributed 99.99% to the average values of the variables considered per class trained in total.

Table 8 below indicates that the first factor the average is mainly characterized by profit or loss (1=29.31 2=33.30 3=21.29 and 4=6.39), Profit / production cost (1=1.42, 2=2.01, 3=0.75 and 4=0.14).

The second factor in relation to profitability the average is (1=58.18 2=66.28, 3=42.00 and 4=12.00)

Table 9 below indicates that most breeders do not have experience in raising pigs despite their lack of training and breeding techniques, we have analyzed this matrix below:

Strategy :

1. Breeders must have training in pig farming and be made aware;
2. To scrupulously respect the instructions given by the technicians (age at weaning, age at breeding, etc.);
3. Train specialists in animal nutrition.

Discussion of Results

Zootechnical parameters

The contribution of two factors (FI and F II) and the total variance observed between the pigsties analyzed on the basis of zootechnical characteristics estimated with the contribution of 47.30%.

FI explains a variance of 31.50% and it is mainly characterized by: weaned piglets, fattening pigs, the age of first farrowing (female) and the number of litter at birth is the positive factor.

Compared to FII explains a variance of (15.50%) is determined negatively and positively by the number of deaths at birth and the age at weaning respectively positive. These observations confirm the hypothesis relating to the second and fourth of this research.

Economic parameters

The contribution of two factors (FI and F II) and the total variance observed between the pigsties analyzed on the basis of pigsties operated for 15 months in relation to the economic variables estimated with the contribution of 99.99%.

Factor I explains a variance of (91.61%) these pigsties have a very low yield on (Profit per piglet -0.98 and profitability -0.98) therefore the factor is negative.

Compared to factor II explains a variance of (8.38%) is determined by the pigsties which present a good economic aspect compared to (Profit per piglet 0.41 as well as profitability 0.19) profitability is positive.

The contribution of two factors (FI and F II) and the total variance observed between the pigsties analyzed on the basis of pigsties operated for 6 months in relation to the economic variables estimated with the contribution of 99.98%.

The FI explains a variance of (97.46%) is mainly characterized by the pigsties (18 and others) presenting a good yield (Profit per piglet 0.99 as well as profitability 0.99) compared to the other pigsties which present a way of profit and profitability

Compared to FII explains a variance of (2.52%) is determined by the pigsties: (19,8,6,13) present a poor performance on the economic aspect compared to (Profit per production cost). His studies are consistent with those of Walter Ossebi (2018) in Senegal.

This allows us to confirm the third and fourth hypotheses of this research on profitability.

Conclusion

This study, carried out as part of the implementation of the characterization of pig farming and its economic impact in the City of Kindu, shows that pig farming remains an important sub-sector in the diversification of food and financial resources. However, the practices used remain a significant problem.

The technical data on pig farming in the City of Kindu is mainly in traditional systems with uncontrolled reproduction practices, a diet based on scavenging and dependent on the availability of agro-household waste and presents good profitability.

The number of weaned piglets, fattening pigs, the age of 1st farrowing/female, the number of deaths at birth and the number of litters at birth present the margin characteristics to the contribution of variance between the pigsties.

The economic data on pig farming, the work is to allow us to see a better knowledge of the marketing circuit of this sector and this through surveys which focus on the production systems and the markets of pigs. The contribution of the factors to the total variability of the pigsties and the correlation between them and the economic variables during 15 months of operation is characterized mainly by the profit/piglet, the yield is negative. The contribution of the factors to the total variability of the pigsties and the correlation between them and the economic variables during 6 months of operation (2nd farrowing) is mainly characterized by the profit/piglet, the yield is positive.

Table 1. Structure and area of the town of Kindu

Municipalities	Neighborhoods	Blocks	Avenues
Alunguli (25 km ²)	Kama II	6	35
	Kabondo	3	6
	Mangobo	9	53
Subtotal	3	8	94
Kasuku (30 km ²)	Basoko	7	48
	Kasuku	6	130
	Lwama	7	34
Subtotal	3	20	212
Mikelenge (46,297 km ²)	Lukunda	7	20
	Mikelenge	8	27
	Tokolote	8	69
Subtotal	3	23	116
Grand Total	9	61	422

Area = 101,295 km²

Anonymous 2018.

Table 2. Contribution of factors to the total variability of pigsties and correlation between them and the variables analyzed

Main Factors (FI et FII)		FI	FII
Own values		3,46474	1,73699
Relative Variance (%)		31,50	15,80
Cumulative variance (%)		31,50	47,30
Variables	Boars	0,03	0,02
	Sows	0,57	0,01
	Piglets under their mother	0,67	0,27
	Weaned piglets	<u>0,86</u>	-0,15
	Fattening pigs	<u>0,83</u>	-0,01
	Age at weaning (days)	0,03	<u>0,75</u>
	Age of castration (days)	0,19	0,34
	Age of first birth/Female (in months)	<u>0,84</u>	0,19
	Number of births/female (year)	-0,04	-0,31
	Number of birth deaths	0,05	<u>-0,81</u>
Number of litters at birth	<u>0,68</u>	-0,18	

Table 3. Membership of pigsties by class based on zootechnical variables

Classes	Pigsty names	Frequencies (%)
1	ACTB,FAP-GNK,FERME DU DIOCESE KINDU,FERME UMAMA,SN-7,FAP-MANANIEMA UNION,FERME TOP BUSINESS.	23,33
2	8è CEPAC, PROSAEMA-MSR SN-29, MANIEMA UNION Cité, FERME UNIKI,PAROISSE St GASTON,FERME-SHENGE,FAP-MATENDA,FERME FALANGA.	30,00
3	117, FERMESHABIN, FAP-LOKALA-WETCHI, SN-24, SN-27, FERMERVA, SN-10, BDOOM-LOKOLE, PROSAEMA-LOMBELA, SN-23, SN-8, F-PAROISSE ALUNGULI, FERMEBARAKA, SN-9.	46,67
Total	30	100,00

Table 4. Average values of the variables considered per trained class

Classes	Number of piglets weaned	Number of fattening pigs	Age at weaning (days)	Age of first birth/Female (in months)	Number of birth deaths	Number of litters at birth
1	34	47	22	12	2	10
2	11	27	46	11	1	8
3	8	6	19	10	1	8

Table 5. Contribution of factors to the total variability of pigsties and correlation between these and economic variables during 15 months of operation

Main Factors (FI et FII)		FI	FII
Own values		2,7484	0,2513
Relative Variance (%)		91,61	8,38
Cumulative variance (%)		91,61	99,99
Variables	Profit per piglet	<u>-0,98</u>	<u>0,41</u>
	Profit/Production cost	0,90	0,19
	Commercial profitability	<u>-0,98</u>	<u>0,19</u>

Table 6. Ownership of pigsties by class based on economic variables during 15 months of operation.

Classes	Pigsty names	Frequencies (%)
1	ACTB (1), 8 ^{ème} CEPAC (2), FAP-MANANIEMA UNION (11), FERME DU DIOCESE KINDU (20) et FERME TOP BUSINESS (22).	16,67
2	117(3), FERME RVA(5), FERME SHABIN (6), SN-9 (9), FERME-SHENGE(19), SN-27(27) et FAP-MATENDA(21).	23,33
3	FAP-GNK(4), SN-7(7), MANIEMA UNION Cité(12), FERME UNIKI(13), FERME FALANGA(25) et SN-29(29).	20,00
4	SN-8(8), SN-10(10), PAROISSE St GASTON(14), BDOOM -LOKOLE(15), FAP-LOKALA-WETCHI(16), PROSAEMA-LOMBELA(17), PROSAEMA-MSR(18), SN-23(23), SN-24, FERME BARAKA(26), FERME UMAMA(28) et F-PAROISSE ALUNGULI(30).	40,00
Total	30	100,00

Table 7. Average values of economic variables during 15 months of operation

Classes	Gain or loss (\$/piglet)	Profit/Production cost (\$/\$)	Profitability(%)
1	12,59	0,34	25,18
2	-81,33	- 0,60	-122,66
3	-4,38	- 0,12	-10,20
4	-25,11	- 0,32	-50,22

Table 8. Contribution of factors to the total variability of pigsties and correlation between these and economic variables during 6 months of operation (2nd farrowing)

Main Factors (FI et FII)		FI	FII
Own values		2,923	0,075
Relative Variance (%)		97,46	2,52
Cumulative variance (%)		97,46	99,98
Variables	Profit per piglet	0,99	0,11
	Profit/Production cost	0,97	-0,22
	Commercial profitability	0,99	0,11

Table 9. Ownership of pigsties by class based on economic variables during 6 months of operation

Classes	Pigsty names	Frequencies (%)
1	ACTB (1), 8 ^e CEPAC (2), 117 (3), SN-7 (7), SN-8(8), SN-9 (9), SN-10 (10), FAP-MANIEMA UNION (11), PAROISSE St GASTON (14), BDOOM -LOKOLE (15), FAP-LOKALA-WETCHI (16), PROSAEMA-LOMBELA (17), FERME DU DIOCESE KINDU (20), FAP-MATENDA (21), FERME TOP BUSINESS (22), FERME BARAKA (26) et F-PAROISSE ALUNGULI (30).	53,33
2	FAP-GNK(4), FERME RVA(5), MANIEMA UNION Cité(12), PROSAEMA-MSR(18), FERME FALANGA(25), SN-27(27), et SN-29 (29).	23,33
3	FERME SHABIN (6), SN-8 (8), FERME UNIKI(13), SN-23(23), SN-24 (24) et FERME UMAMA(28).	20,00
4	FERME-SHENGE(19).	3,33
Total	30	100,00

Strategy :

1. Breeders must have training in pig farming and be made aware;
2. To scrupulously respect the instructions given by the technicians (age at weaning, age at breeding, etc.);
3. Train specialists in animal nutrition.

Table 10. Average values of economic variables during 6 months of operation

Classes	Gain or loss (\$/piglet)	Profit/Production cost (\$/\$)	Profitability (%)
1	29,31	1,42	58,18
2	33,30	2,01	66,28
3	21,29	0,75	42,00
4	6,39	0,14	12,00

Table 11. Pig farm MOFF matrix

	Positive factors	Negative factors
Internal	- Technical sheet - Growth - Prolific - Building - Improved breed - Omnivorous - Prophylaxis - Saving - Dropping	- Religious contravention - Lack of monitoring of breeding - Use of local medical products - Construction with sheets - Local breed - High disease susceptibility - Cannibalism - Food competition with humans
	OPPORTUNITIES	THREAT
External	-Rice bran - Greenery - Veterinarian - Job creation - Granting micro credits to breeders	-Pollution - Destruction - Zoonosis - Animal theft - Strong wind and heat

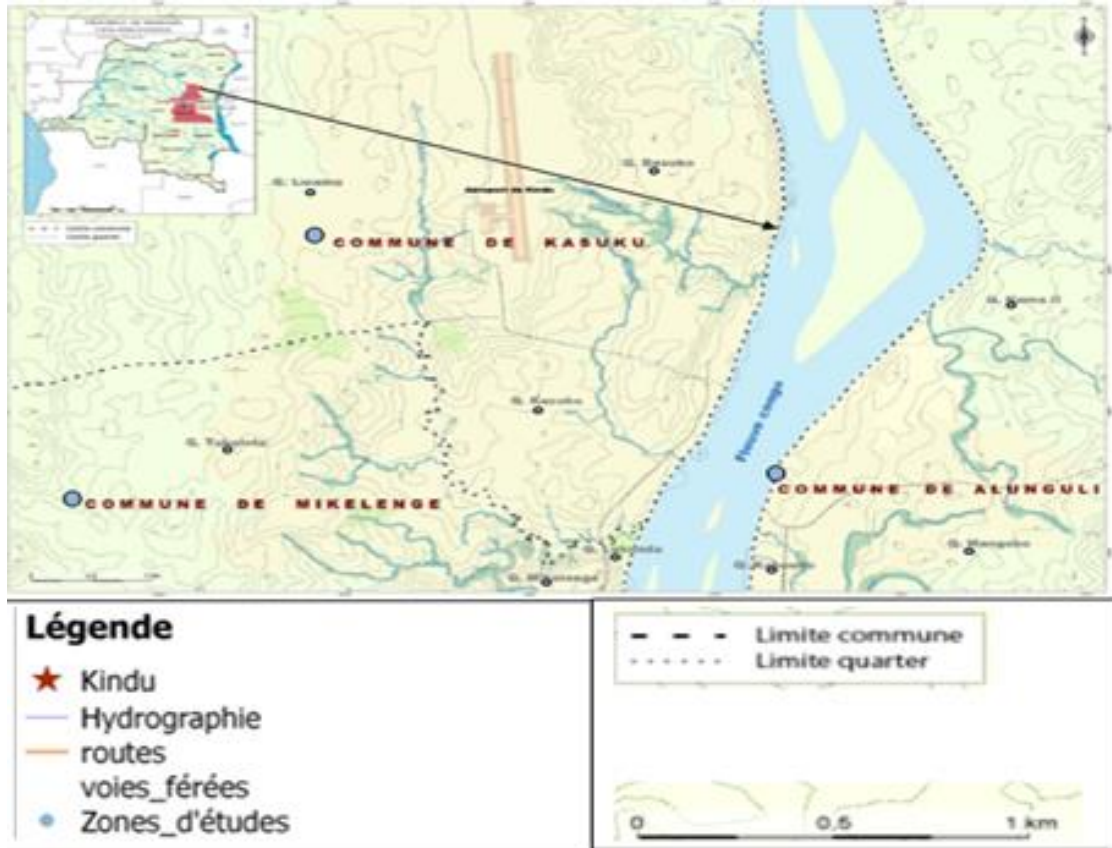


Figure 1. Location of study environments. Source: Personal initiative(ArcGIS)



2018 field survey. Field survey 2018. By Ir MYONGE

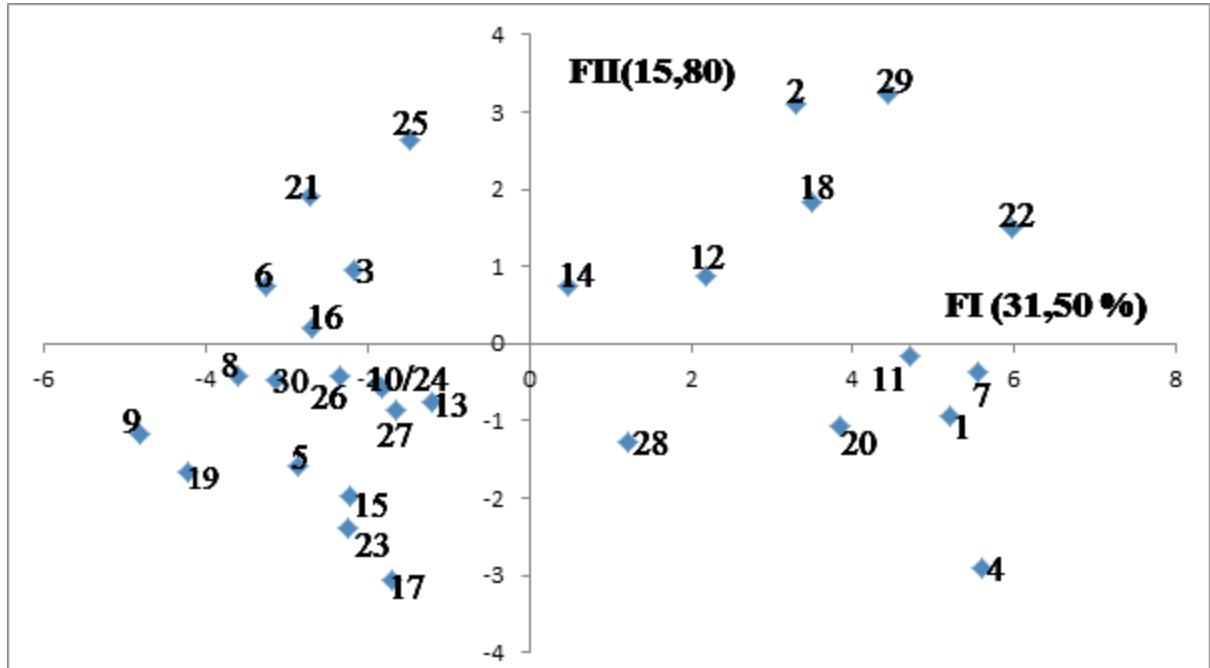


Figure 2. Spatial distribution of pigsties in relation to zootechnical variables

Legend :		
1= ACTB	11= FAP-MANANIEMA UNION	21= FAP-MATENDA
2=8è CEPAC	12= F-MANIEMA UNION Cité	22= FARM TOP BUSINESS
3=117	13= FARM UNIKI	23= SN-23
4= FAP-GNK	14= PAROISSE St GASTON	24= SN-24
5= FARM RVA	15= F-BDOOM-LOKOLE	25= FARM FALANGA
6= FARM SHABIN	16= FAP-LOKALA-WETCHI	26= FARM BARAKA
7= SN-7	17= PROSAEMA-LOMBELA	27= SN-27
8= SN-8	18= PROSAEMA-MSR	28= FARM UMAMA
9= SN-9	19= FARM-SHENGE	29= SN-29
10= SN-10	20= F- DU DIOCESE KINDU	30= F-PARISH ALUNGULI

Figure 2 shows the grouping of pigsties taking into account its spatial distribution (Figure 2), where three groups were formed.

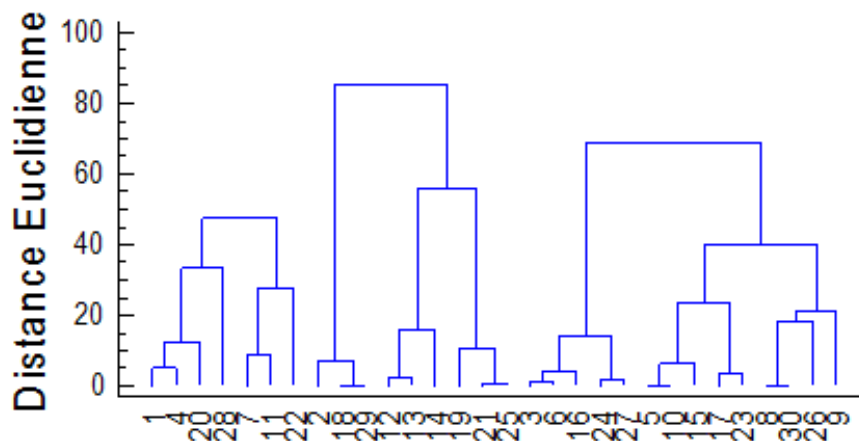


Figure 3. Dendrogram of pigsties in relation to zootechnical variables

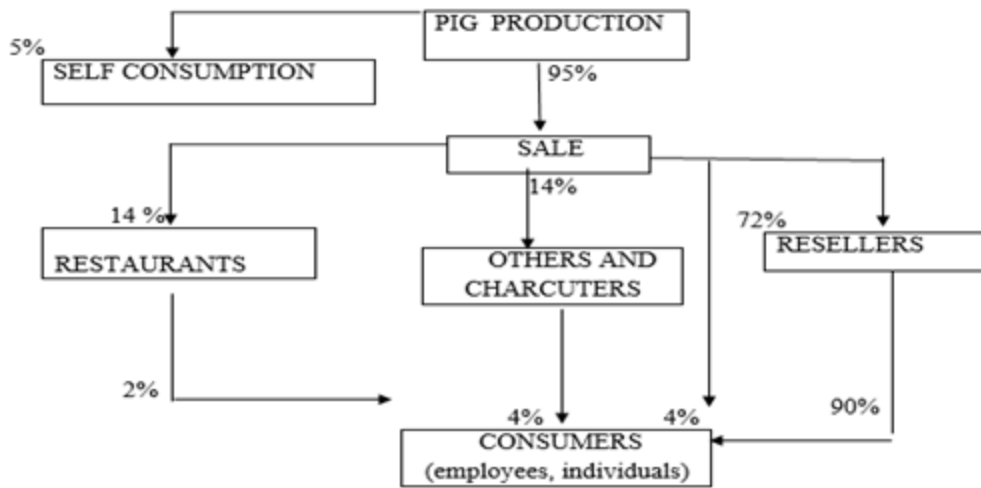


Figure 4. Pig meat marketing circuit in the town of Kindu

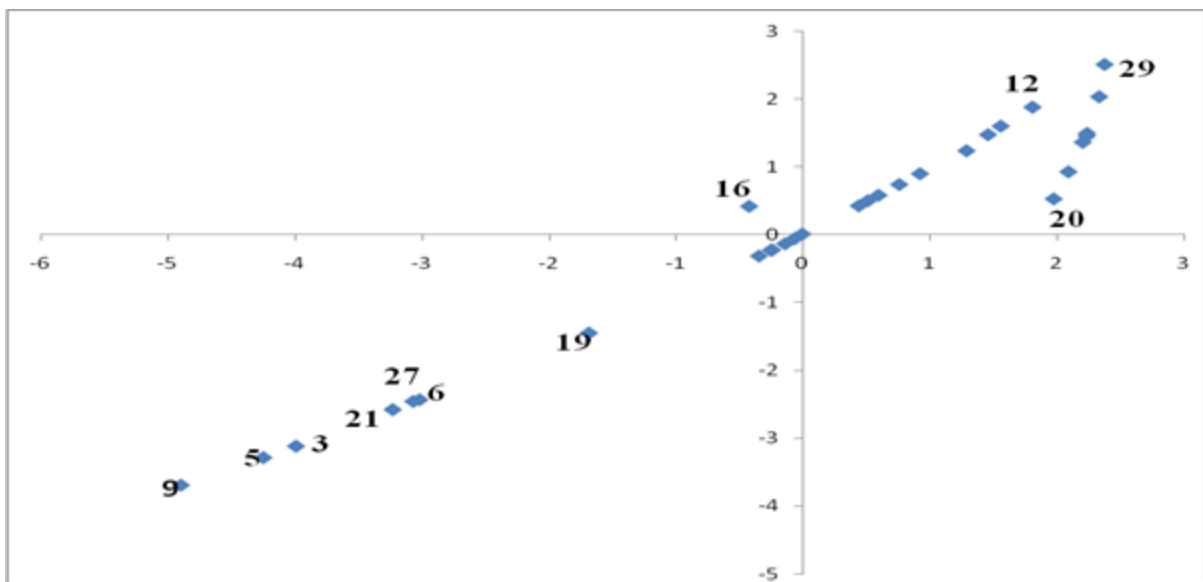


Figure 5. Spatial distribution of piggeries in relation to variables during 15 months of operation

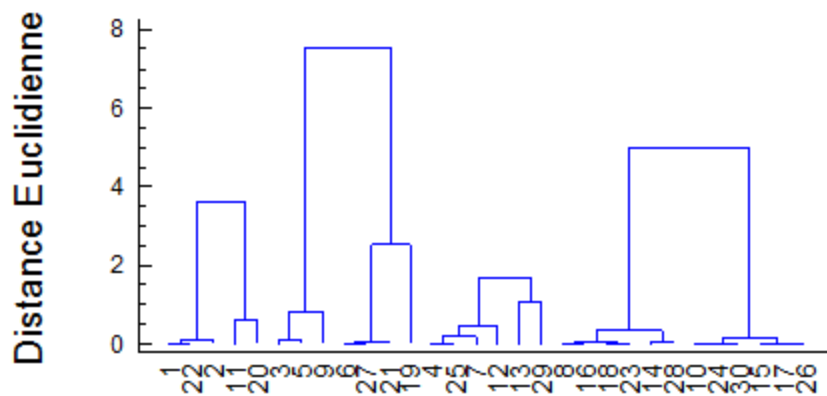


Figure 6. Dendrogram of pigties in relation to economic variables during 15 months of operation

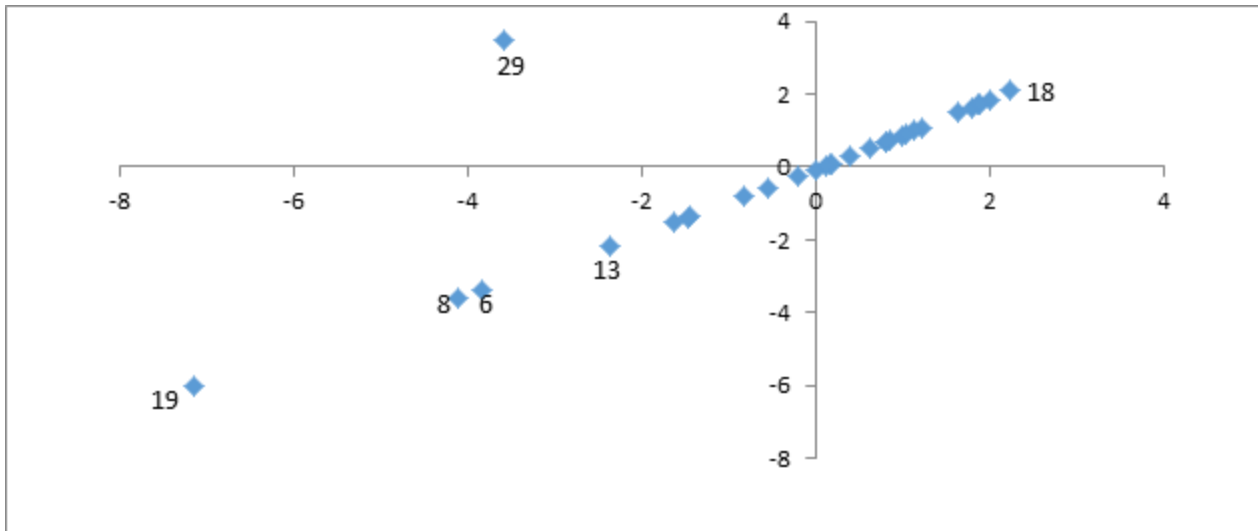


Figure 7. Spatial distribution of pigsties in relation to economic variables during 6 months of operation

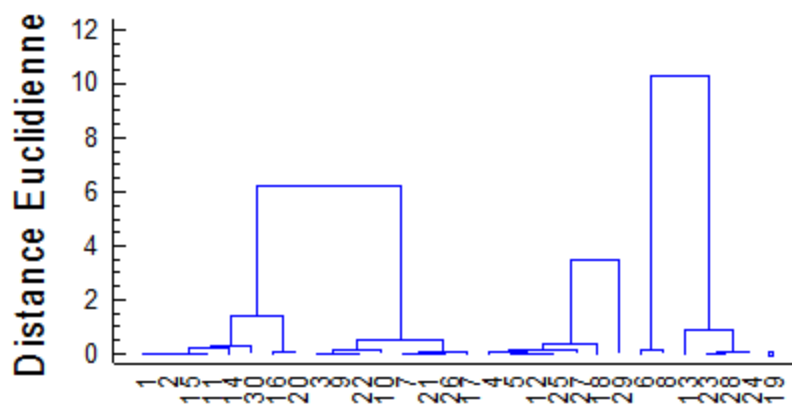


Figure 8. Dendrogram of pigsties in relation to economic variables during 6 months of operation

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