DIAGNOSTIC AND TYPOLOGY OF ECONOMIC FUNCTIONING OF FARMING SYSTEMS IN THE SOUTHERN PROVINCE OF RWANDA. CASE STUDY OF NYAMAGABE AND NYARUGURU DISTRICTS

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ABSTRACT

Considered as the main engine for economic growth and poverty reduction, the Rwandan agriculture sector has entered into a period of great transformation and modernization of its farming systems to open itself to the market. To get there however, many problems and various agricultural challenges of a different nature and level in every region need first to be identified and analyzed for passing to the action. This study is designed to advance further current reforms by defining and analyzing the socio-economic problems and challenges of farming systems based on a study case of Nyamagabe and Nyarugura District in the Southern Province. To get a grip on the subject, a rapid desk review has been conducted on the region and Rwandan agricultural situation in general followed by a survey done on 210 farming households randomly chosen. The data analysis and results have led to the division of farms into three categories following principles:

In the first group, there are very poor farmers living below the survival threshold. Evaluated at 39%, these farms have very small land, labor is limited, livestock is absent or reduced to a single animal. The majority of these farms provide remarkably below the reproduction threshold income (375,000 Rwf.) and many of them cannot even exceed the survival threshold (250,000 Rwf).

In the second group, there are agriculture-livestock dominated farms (47%) where these activities provide the largest share of monetary income. They live much on their agricultural productions and the livestock is often the primary source of liquidity; investment capacities are still very limited. They are in more or less stable equilibrium regarding expenses and products. In case of serious problem (illness, death, loss of animals, etc.), they decline with a rapid impoverishment: animals’ sales greater than the herd increase rate, rental of the labor force and land sales to finally find themselves in the situation of poor farms.
The third and last group includes farms supported by a salary employee or by a generating income off-farm activity (14%). They have a very good cash flow and invest in a noticeable way in agriculture (purchase of inputs, payment of labor) and livestock (purchase of animals). Their tendency is to the capitalization: purchase of land and animals, improve their production capital through the use of employees, etc...

The general outcome of this study is that demographical, economic, social or cultural changes that affected the studied area for decades did not equally inspire a dynamic organizational transformation to allow the development and reinforcement of capacity of farmers and organizations facing the new challenges of rural development.

**Key words:** Soil fertility, Rural poverty, Declining farms, Stagnant farms, Nyamagabe

1- INTRODUCTION

The history of the programs and projects of agricultural development show that there cannot be effective interventions on the agriculture transformations without preliminary scientific knowledge of agrarian realities on which one proposes to intervene. Many projects are still unfortunately doomed to failure because of the breach of the conditions and terms of agricultural development which initially showed their authors. So is it, for example, projects based on the extension of a limited number of technical standards (sowing densities, fertilizer doses,...) without taking into account the diversity of socio-economic and agro-ecological in which farmers operate.

The uniformity of proposals often proves inadequate to the multitude of situations faced by farmers. The most common mistake is not to seek to know the real needs and problems of farmers from the project design. Faced with repeated errors such agricultural development programs designed and made in complete ignorance of realities, many institutions now emphasize the importance of prior to any intervention diagnostic analysis.

The objective is to formulate actions to be taken on the basis of a relatively rigorous understanding of agricultural development to inflect (MULLER P. et al., 1989).

According to VALCESCHINI E. (1985), the diagnostic analysis of agrarian realities has as main objective to identify and prioritize the agro-ecological, technical and socio-economic elements that condition the more the evolution of agricultural production systems and understand how they interfere specifically on agriculture transformation. The key is to be able to characterize the technical, economic and social practices of farmers, and understand what governs their evolution in relation to those of other socio-professional categories.

The diagnostic analysis should also be able to predict what might be the subsequent transformations of agrarian realities that we intervene or not in the form of projects. This diagnostic analysis aims at formulating relatively realistic assumptions about the evolution of a great number of variables (exploited area, number of herds, yields, prices, employment, etc...) with or without state intervention. It should help in providing
a therapeutic and recommendations if
the need arises.

2- Theoretical and conceptual
framework of the diagnostic analysis
of a rural area

The diagnostic analysis of the
socioeconomic functioning of farms
put a focus on the structures, systems
and production methods, components,
relationships and agro-technical aspects.
This analysis allows the update of the
strengths, constraints and contradictions
existing in the rural area.

According to Broussard (1986, 1992) the
cycle of production-reproduction begins
with two great types of operations:

(i) The transformation of the consumer
goods into work in the cycle of
production. The work which will be
completed during the farming cycle
supposes that the farmer and his
family can satisfy a certain number of
needs. These needs are of several types
narrowly articulated between them.
Strict economic point of view, they are
reduced to the consumption of a certain
number of goods and services;

(ii) The transformation of work into
production by the combination between
land, means of production and labor
force. This combination indeed makes
it possible to launch initially and to
then accompany a new vegetative or
animal cycle, which will lead to a new
production allowing a new cycle to start.

These operations can gather in two
categories whose economic functions
are different: the production process
and the reproduction one. That assumes,
of course, that these decisions and
operations obey an economic rationality
allowing defining the three significant
economic phenomena of expansion,
stagnation and regression of the farms.

There are generally two uses of the value
of production which are revealed: the
necessary production and the surplus.
The three variables which are the total
production, the necessary production and
the surplus are very interrelated. One can
indeed be found in the following three
situations:

(i) Situation A: the total production
is greater than the necessary
production: in this case there
is appearance of a surplus and
possibility of expansion of the
productive system;

(ii) Situation B: the total
production is equal to the
necessary production: there is
no surplus and thus an identical
reproduction of the production
unit;
(iii) Situation C: the total production is less than the required production: there is no surplus and thus an economic decline of the farm.

The identification of these three situations is fundamental to the analysis of a rural area. It is, in fact, that determines what will be, by sector, the strategy to be set up.

The analysis of the failures of many development projects carried out by Lecomte (1983), shows indeed that these failures are largely due to the fact that production units of each category were treated as if their situation vis-à-vis the reproduction process was the same. But they are not the same actions which allow some of the farms to stop their decline, the others to begin their expansion and others finally to consolidate their development. It is thus quite clear that more adapted strategies, according to cases, are required and in certain cases imperative for better orient the production units in a process of sustainable development.

Still, it is essential for the analysis of knowing how are effectively distributed the production units in these three groups. Indeed, if the existence of investment can be a sign that the production unit is in the first category (development), its absence does not mean the opposite because the surplus can be used as stock, hoarding or social consumption. Similarly, if the sale of part of the assets generally means that the unit of production is declining, one also observes that the border is often very thin between the situation of stagnation and that of regression (Peltier C., 1992).

Admittedly, in the long term, these adjustments are not significant in a macroeconomic perspective (regional or even national level at a branch). Explanations proposed then by Mazoyer (1997) can then be retained. But for zonal analysis and support to the definition of local development strategies, which is our purpose, we need to implement a more detailed analysis. This is to ascertain for which production units there is surplus and among those who do not have, which ones are below the identical reproduction. This means that the assessment of production required is necessary to conduct the analysis.

3- METHODOLOGICAL APPROACH

The methodological approach used to apprehend this study is based on two essential points: the general approach of diagnostic analysis of a rural area and the method of data analysis on the socio-economic functioning of farms.

3.1- The general approach

The study steps are based on an approach of rural development and farms. The concept to which refers the method is the “reproduction of production units” (Tahani A., 2000 and Eloumi, 1990), that is to say what is the mode of reproduction of the farms? And how do they come to this mode of reproduction? And why?

To answer these three fundamental questions will reveal the strengths and constraints of development of the area from the point of view of its socio-economic functioning, and therefore, identify blockages to change and resources to develop. The approach is organized into four main and
successive stages: literature review, data collection from farms, data analysis and interpretation of results and synthesis (MATTHESS G., 1991).

3.2- Sampling method

The size of the reference population and the space dimension which the survey should cover require a combination of a simple geographical cluster sampling for sectors and a purposive sampling of farmers within sectors to overcome the difficulties caused by the large population and space size but by taking into account the diversity of the agro-bioclimate conditions of the zone. Indeed in that former zone of Gikongoro, the altitude and the rainfall increase while the temperatures decrease from east to west. This induces a remarkable farming diversity where, in the East the food crops are dominated by bean, cassava, potato and sorghum with coffee as the only industrial crop while in the West these last are replaced by potato, wheat, pea and the tea like industrial crop (EUROSTAT, 1978).

The study area extends over two Districts: Nyamagabe and Nyaruguru comprising 17 and 14 sectors respectively. For taking into account the diversity of the agro-bioclimate conditions of the area, 2 sectors of high altitude and 2 of low altitude were located to belong to the sample, that is to say 4 sectors per District and 8 sectors for the whole of the studied zone. The figure 1 hereafter highlights the route followed to draw the sample.

![Sampling Schematic route and size](image)

Figure 1. Sampling Schematic route and size
3.4. Analysis method

The method of diagnostic analysis of socio-economic functioning of farms proposes the study of three categories of socio-economic variables:

1. The structure variables that describe the structures of the production units with reference to the components of the production system including land and modes to put forward;

2. The variables of economic functioning which make it possible to know the economic results of the production unit, and the distribution of the value of agricultural production.

3. The variables of strategy which relate at the same time to the history and the future of the manufacturing unit. They will make it possible to know the implicit or explicit strategies producers as well as the technical and economic choices of the producer.

4. RESULTS AND DISCUSSIONS

4.1. Miniaturization of farms and land distribution

The current farming context of Rwanda is mainly characterized by the high population densities which led to a rapid miniaturization of the family farms (table 1) and an abusive use of space. This miniaturization increasingly larger of the family farms combined with the reduction of the fallow and a “mining” agriculture involve an overexploitation of arable lands where biological regeneration proves to be insufficient followed by an accelerated destruction of the organic matter and structure of the soils.

<table>
<thead>
<tr>
<th>Classes of Utilized Agricultural Area, UAA (ares)</th>
<th>Total number of farms (1984)</th>
<th>Evolution (%)/period (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAA &lt; 50 ares</td>
<td>19,752</td>
<td>24%</td>
</tr>
<tr>
<td>50 ares &lt; UAA &lt; 100 ares</td>
<td>28,808</td>
<td>35%</td>
</tr>
<tr>
<td>UAA &gt; 100 ares</td>
<td>33,747</td>
<td>41%</td>
</tr>
<tr>
<td>Total</td>
<td>82,307</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source: MINAGRI (2004, 2008) and Author: Primary data, Survey of December 2012

The low availability of land, coupled with an unequal arable land distribution involves on the one hand, the cultivation of fragile lands (steep slopes, river banks and lower slopes especially) which would have been better to keep as pasture or as woodland, and on the other hand, the existence of very small dimensions farms. The table 1 illustrates and quantifies the extent of this phenomenon.
The lack of organic and mineral inputs and erosion contribute to a general impoverishment of the soil, especially in the small-scale farmings. Generally in the area, the cultivated soils are strongly acidic with a pH below 4.7 and being able to go down up to 3.2. Their content of exchangeable aluminium is high and they are characterized by high desaturation in exchangeable cations. These chemical properties are unfavorable to agriculture.

The average arable land is 44.5 acres with a standard deviation of 79.8 acres. The high dispersion of data around the mean forces us to analyze the distribution and the concentration of land in agricultural households (figure 2). In the study area, more than 60% of farm households exploit less than 0.50 ha and 81% of households less than 1 ha of land while the FAO estimates that 0.9 acres are needed to meet the food needs of the household in Rwanda.

![Figure 2. Lorenz curve of the arable lands in function of the population](http://www.eajscience.com)

Source : Author: Primary data, Survey of December 2012

The concentration index is 0.617, which is particularly high, reflecting a greater inequality of wealth in land among farm households. Indeed, the figure 2 shows that over 60% of the population have only 15% of arable lands, as opposed to 8% of the population who account monopolize 48% of them.

### 4.2. The overall decline in agricultural yields and food security.

This soil depletion leads the farmers to use a hardware rustic plantation but with very low production potential and causes a general decrease in yields. The decrease of the agricultural outputs and the reduction of the acreages per household involve, per capita, a fall of the production, primarily food. At the national level, the shift between the evolution of the population and the progression of the food productions involve a trend decreasing in food availabilities per person.

The low farm and off-farm incomes and off-farm induced for some households, a very weak purchase power. For a farm household, the average gross added value is estimated at 288,780 Rwandan francs per annum.

The limited food offer, due to weak purchasing power of a part of the population, leads to serious food insecurity mainly in the small-scale farming.

### 4.3. Farm typology

While reviewing in a thorough way, the data on 50% of farms randomly chosen (105), we find that they have each well-differentiated features, both in terms of resources (land, labor, livestock) and functioning, also at the level of allocation of expenses or the type of income. The typology of farms was made based on
three important criteria:

(i) Survival threshold: this is the level of income below which it is no longer possible for a farm to ensure the subsistence for the family. For Rwandan rural areas, the survival threshold is estimated at Rwf 250,000 Rwandan Francs (1 $/day). All the farms which produce below this threshold are unable to meet the food needs for the household and carry out a very poor and miserable life.

(ii) Reproduction threshold: this acts according Dufumier (1996, 2004) of the level of income below which it is no longer possible for a farm to ensure at the same time the renewal of the operation capital and the subsistence for the family. As part of this study, this threshold is estimated at 50% more than the survival threshold, or 375,000 Rwandan francs. All the production units that provide incomes below the reproduction threshold are logically poor and condemned to disappear (if farmers do not have other sources of income) to the extent that the survival of farm households can only be ensured by consuming the exploitation capital (farms in decapitalization).

Figure 4. Households’ agricultural income according to the utilized agricultural area

Source : Author: Primary data, Survey of December 2012
(iii) Accumulation threshold: this is the level of income below which it is no longer possible for a farm or a business to remain competitive and to make new investments. The personal estimates of this study set the accumulation threshold at twice the survival threshold, or 500,000 Rwandan Francs.

A. Poor and declining farms

In the first group (G1), there are very poor farms having at the same time a little bit of land and labor; without external support and without significant off-farm activity. They live in poverty and have no capacity to invest. Evaluated at 39%, poor farms have very small land available, the labor is limited, livestock is absent or reduced to a single animal. The majority of these farms produce remarkably below the reproduction threshold income (375,000 Rwf) and some of them are not even able to exceed the survival threshold of (250,000 Rwf.).

These farms of the first category (G1) therefore fail to meet the incompressible needs of their families. To survive one of the family members will occasionally work with other farmers (sale of labor force). These farms are in declining conditions and logically doomed to disappear if nothing is done. The utilized agricultural area, however, seems to be the main limiting factor for these poor farms, as shown in the figure 4, with a gross added value per unit of area (hectare) two to three times greater than those of large farms.

Figure 4. Gross added value of farms, in RwF/ha

Source: Author: Primary data, Survey of December 2012
This chart is very important and shows how the gross added value per unit of area (GA V/ha) is a decreasing function of the utilized agricultural area (UAA). The small farms tend to improve their added value per unit of area by intensifying the use of the labor, high density seed rate, intercropping and fighting against erosion by radical terraces.

B. Agriculture and livestock dominated farms (stagnant).

Evaluated at 47% of the sample, in the second group (G2) we find the Agriculture and Livestock Dominated Farms where these two activities provide the largest share of cash income. They consume much of their agricultural production and the livestock is the main source of liquidity. The investment capacities of them are still very limited. They are somehow in a stable economic balance with regard to the charges and products. In case of serious problems (illness, death, loss of animals, etc.), they quickly decline: sales of animals greater than the herd growth rate, sales of labor force and land, etc.; to finally find themselves in the situation of poor farms.

The off-farm activities are often reduced to the processing of agricultural products (mostly banana wine and sorghum beer). The access to agricultural inputs is very limited. In the majority of these farms, the total agricultural production is almost equal to the production needed to support the family and the reproduction of the working capital and thus provide slightly above the threshold of reproduction income. They are therefore stagnant farms knowing neither development nor regression. In such cases where there is no loss or surplus, it is about the identical reproduction of the farms.

C. External resources supported farms (expanding)

Representing 14% of the sample, we find in the third group (G3) the farms economically supported by an employee (outside of agriculture sector) or by off-farm activities. They have a very good treasury and invest in a noticeable way in agriculture (input purchase, labor use) and livestock (purchase of animals). Their general trend is in investing: purchase of land and animals, improvement of their production capital through the intensive use of the labor, etc.

The purchasing power of this type of farms and the regular inflow of cash income allow them to invest in livestock, agriculture and according to their geographical positions in small businesses. The adoption of innovations in agriculture or livestock is often easier to them than for others. Their off-farm incomes allow them to take risks that cannot afford those who live from the agriculture only. These farms produce largely above the accumulation threshold.

5- CONCLUSION ET RECOMMANDATIONS

Formulating a diagnosis of operation and type of farms in a given region is the first step in preparation of development projects and programs. Methodologically, the first step consisted in collecting and synthesizing of all available information on the area. Then, a survey was done on 210 farming households randomly.
chosen to gather information and data on problems and constraints they are facing.

The first outcome of this study is that the demographical, economical, social and cultural changes that affected the two Districts for decades did not equally inspire a dynamic organizational transformation to allow the development and reinforcement of the capacities of farmers and organizations facing the new challenges of rural development. On agronomical level, the first limiting factor to many others is the critical impoverishment of soils due mainly to an overexploitation of the small arable land available. Therefore, the low levels of productivity, due to a reduction of available agricultural land per person, cause a general slow down of agricultural production. This is remarkable in a permanent or temporary shortage of food affecting mainly the small farmers.

According to different variables of structure, economic operation and strategy, the results have led to the grouping of farms into three following categories:

The first category is composed by very poor farmers evaluated at 39% living below the survival threshold. The second group is made by agriculture-livestock dominated farms (47%). They essentially live on their agricultural production and the livestock is the primary source of liquidity.

The remaining 14% of the farms are in a developing process. This third and last group includes farms supported by salary or by a generating income off-farm activity.

The improvement of the efficiency of the agriculture and livestock, the support of development of micro and small income generating enterprises and the participative management of the environment are recommended as actions to ensure a socio-economic evolution of the region.

REFERENCES


MATTHESS G. [1991]. Suivi socio-économique des exploitations paysannes : conception,


MINAGRI [1988]. Enquête Nationale Agricole. MINAGRI : Kigali

MINAGRI [2008]. Plan stratégique de transformation de l’agriculture. MINAGRI : Kigali


