August 2012 n° 27

Farming dynamics

"Sharing the financial burden of land development: a new ambition for rice farmers in Office du Niger in Mali"

Rice harvesting in Office du Niger: mechanization is basic.

Office du Niger (ON) is one of the oldest irrigated areas in West Africa. It was started in the 1930s in the inland delta of the Niger River in Mali, about 250 km north of Bamako. At the outset, the intention was to produce cotton for the textile industries of colonial France. The initial objectives were very ambitious with 1 million ha to be developed over 50 years. The reality however has been different. The area that has been developed currently covers 90,000 ha and rice has replaced cotton. Half of Malian rice is produced here. There are about 253 villages, 35,000 farms and 417,000 inhabitants in ON. Most of these farms operate on the basis of an annual contract, in which a "water fee" is paid in exchange for land use and tenure rights.

The stakes in ON are huge, both in terms of food security, economic growth as well as the fight against poverty. After several reorganization attempts, ON has become an Industrial and Commercial Public Establishment (French acronym, EPIC), supervised by the State Secretariat in charge of the Office du Niger Integrated Development Zone (French acronym, SEDIZON), which reports to the Prime Minister.

The ON case raises the wider question of whether African family farms are able to shoulder some of the cost of building irrigation infrastructure.

Context and presentation of the study "Investor farmers"

Specific ON zone constraints

Rice farmers in the zone came together in 1996 to form the Farmers' Union of Office du Niger (SEXAGON) to defend the interests of farmers in the area. The union currently has approximately 15,000 members.
Based on two observations:

- that the average family farm in ON is no longer big enough to be profitable;
- that the pace at which the area is being irrigated by the Malian government (with donor financing) is too slow;

SEXAGON decided to propose a different way of managing land in ON and to look into its feasibility.

The study commissioned by SEXAGON was supported by several development entities, including SOS Faim.

Presentation of the study

The study is divided into three parts: the first part was designed to look closer at SEXAGON's two observations and examine the economic feasibility of its proposals, the second part investigates the feasibility of legal and financial aspects and the third part aims to test SEXAGON's proposals through a pilot land development scheme.

This article presents the results of the first part of this study entitled "Investor farmers" by answering questions such as:

- What is the minimum size a family farm must be to be viable and to encourage investment?
- What proportion of this investment capacity can be used to finance irrigation in additional ON areas?
- What accompanying measures should be envisaged in order to limit the risk of family farms defaulting on their payments?

Surveys were used to carry out a systematic study of the tenure, technical, economic and social situation of family farms in ON. Approximately 640 surveys were conducted during this study, resulting in the collection of approximately 120,000 data entries. This data was then processed to build 60 easily understood graphic models. These models are derived from a combination of three variables: 5 crop combinations, three equipment levels and four family compositions.

Variables in the study

The crop combinations[1]

Among the crops grown by family farms in ON, the study identified:

- Rice cultivation during the rainy season, commonly called **rainy season rice,** which is planted on all farms, across the whole area of the holding;
- The cultivation of irrigated dry season rice, commonly known as **off-season rice which is only grown on a small portion of the farm;**
- Irrigated dry-season vegetable crops, commonly known as **market gardening,** which are very labour intensive, and occupy even smaller areas;

Five basic crop combinations were focused on by the study:

- Rainy season rice on 100% of the available space;
- Rainy season rice on 100%, and off-season rice on 25%, of the available space;
- Rainy season rice on 100%, and market gardening on 10%, of the available space;
- Rainy season rice on 100%, off-season rice on 25%, and market gardening on 10% of the available space;
- Rainy season rice on 100%, and off-season rice on 100%, of the available space.

Equipment levels

Farm tools and equipment determine the maximum area that can be cultivated by active family members, as well as determining the income that can be generated by, and the investment capacity of, family farms. Three basic equipment levels were selected:

1: Livestock activities were also taken into account but these were of secondary importance.

© SOS Faim.

The stakes in ON are huge, both in terms of food security, economic growth as well as the fight against poverty.

- **Farms with hand tools** only that rely on agricultural service providers.
- **Farms with comprehensive animal traction equipment** (at least one pair of oxen, a plough and a harrow and possibly a donkey and a cart) and, also, with all the usual hand tools.
- **Farms with mechanized equipment** (at least one rototiller and in some cases a thresher and dehusker) and generally animal traction equipment and of course all the usual hand tools.

Family composition

A family farm is made of people with various family ties, who work and live on the farm. The families consist of one to ten households managed by a head of the family. These households are themselves composed of one or more "maternal cells", each with zero to ten children. This means that the number of active family members and the number of people a family is responsible for, vary greatly from one family to another. Farm families can indeed include from 3 to over 100 individuals depending on the total number of maternal cells. Accordingly, based on the number of maternal cells, the study identified four family compositions:

> the number of active family members and the number of people a family is responsible for, vary greatly from one family to another.

- **Single family** with a single maternal cell;
- **Double family** with two maternal cells;
- **Triple family** with three maternal cells;
- **Large family** of more than three maternal cells.

For each of these family compositions, maximum consumption needs (expenses) and the maximum area under cultivation by household members were determined through surveys.

Details of the economic calculations made in the study[2]

As a reminder, this study aims in particular to determine the investment capacity of family farms in ON. The investment capacity of a family farm is equal to the farm's income, minus it's family's consumption needs. Calculating the farm's investment capacity thus depends in the first instance on the farm's income.

The farm's income is equal to the value of the farm's plant and animal products[3] (sold and consumed), less the value of goods and services expended to produce them, which are of two types: intermediate consumption (seeds, fertilizers, veterinary expenses, livestock feed and other inputs, services paid to third parties, water fees ...) and depreciation costs and annual maintenance of farm buildings and equipment.

Calculating the farm's income, involves the following steps:

- Calculating the **gross value added for each of the crops** grown (rainy season rice, off-season rice, shallots and other off-season vegetables) (gross value added of a crop = **gross product - intermediate consumption)**;
- Calculating the **gross value added of each breed,** by multiplying an estimated average gross value added per animal by the number of breeding animals in each breed;
- Totalling the gross value added of each crop and breed provides **the total gross value added** of the farm;
- Calculating a **farm's total net value added** by deducting from its total gross value added, the annual cost of depreciation and maintenance of buildings and equipment;

2: This paragraph is drawn in its entirety from the interim report of the study, written by Benoît Dave, March 2012.

3: Farm income is calculated based on given yield and prices, i.e. on the median yield and prices observed in 2010. The average yield of the 2010 winter season appears to be one of the worst of the past 10 years.

- Finally, calculating **a farm's income** by deducting from it's net value added, the wages, rents, interest on borrowed capital, and adding the revenue paid to the head of the farm for agricultural services to third parties.

Calculating a family farm's **investment capacity** is achieved by deducting the consumption needs the head farmer is responsible for from the farm's income (that is, the income he has at his disposal).

Understanding the study's results

To ease interpretation, the study presented its results in graph format, bringing together in one diagram the key measures that were analysed, namely farm income in CFA francs, consumption needs and the farmers' contribution to financing land development. The following conventions and abbreviations are used in this article:

- **RSR:** rainy season rice;
- **OSR:** off-season rice;
- **MAR:** market gardening (shallots or other vegetable crops);
- **100%/25%/10%:** these percentages indicate what proportions of the available plots were planted with rainy season rice, off-season rice or market gardening.

For example, Graph 1 is of a family farm with three maternal cells, which has mechanized equipment and production systems that combine rainy season rice on 100%, off-season rice on 25% and market gardening on 10% of the available land. Economically speaking, this is the most attractive combination, while keeping in mind the following constraints:

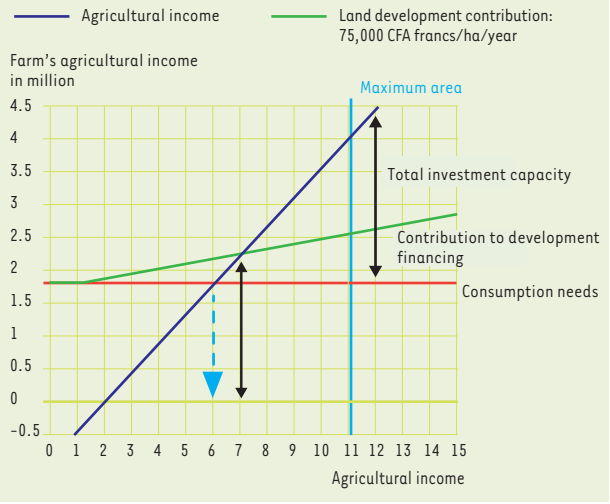
- The lack of water during the hot dry season (April-May) that prevents planting 100% of the available land. Off-season rice is therefore limited to 25%, although economically it would be interesting to maximize off-season rice growing;
- The availability of manpower. The study showed that market gardening demanded seven times more labour than growing rice, leading farmers to restrict market gardening to 10% of the available land. Note that in the case of market gardening, water availability is not a problem as planting takes place in the cold dry season (November to March)

Understanding the graph:

- The relationship between agricultural income and farm size (in hectares) is represented by the slanting dark blue line.
- Consumption needs, which the head of the family is responsible for, are represented by the horizontal red line. These are determined by the composition of the family. Surveys for the study indicate that a family made up of three maternal cells, has a maximum of 18 people in it (see tables below). Consumption needs were also assessed as 100,000 CFA francs/person, and so a maximum of 1,800,000 CFA francs in this case.
- The minimum economically viable farm size is given by the intersection between income and consumption needs, as indicated by the blue arrow. To fully meet its consumption needs, a three cell family requires a minimum of 6 hectares.
- Total investment capacity is the difference between income (slanting dark blue line) and consumption needs (horizontal red line).
- The contribution to financing land development is represented by the green line. The model presented assumes a contribution of 75,000 CFA francs/ha/year[4] for farms of at least 1 hectare in size. The minimum income level as of which it is possible to pay this contribution, is given by the intersection between the income (slanting dark blue) line and the contribution to the financing arrangements (green) line. In this case, this intersection indicates that the holding must be of at least 7 hectares in order to support consumption needs and have enough income left over to pay this contribution to land development.
- However, farmers must have sufficient leeway in order to make other investments aside from their contribution to land development financing. Therefore the required farm size is much closer to the maximum area that can be farmed according to the size of the workforce.
- The maximum area of land that can be cultivated is represented by the blue vertical line. The size of this area is calculated based on surveys of the number of man hours required at different stages of the crop cycle, taking into account the equipment available and household composition. In this example, the size of the area is 11 hectares. See the tables below.

4: This amount was determined by researchers through a process of iteration. The contribution needed to represent a sizeable stake in the cost of developing the irrigation schemes (more or less a third of the cost) while allowing farmers sufficient surplus income for other investments, such that their development would not be blocked over the following 20 years.

Production system
RH100% + MAR 10% + RCS 25%
Mechanized equipment 3 maternal cells



Graph 1.

- In conclusion, with a farm size of between 7 and 11 hectares the farmer has sufficient income to support his family's consumption needs and to contribute, up to 75,000 CFA francs/ha/year, to land development financing. Additional investment capacity is also allowed for in order for the farmer to continue to invest and grow.

The study's most important results

The results of this study are particularly important, as they update the expertise that supports the implementation and sustainability of long-term "land development" credits. The most significant results of the study, for this programme of long-term credits, are illustrated below.

Distribution of family farms by equipment level and crop system

In table 1 we can see that:
- 49% of family farms only have hand tools
- 67% (32% + 35%) already plant off-season rice
- 51% (16% + 35%) already cultivate market gardens

Distribution of families by composition and its effect on consumption needs and the maximum area a family can cultivate.

Table 2 shows that:
- Over two thirds of families are made up of more than three maternal cells
- Farms must generate as much as 1.4 million CFA francs to cover the consumption needs of a two cell family.
- On the other hand, based on surveys of work hours required for different crops, it is estimated that with animal traction, 1 FTE is required in order to cultivate 1 hectare of rice, and with mechanized cultivation, 1 FTE can cultivate 1.2 hectares[5]. With this data, we can determine the maximum area that can be cultivated according to family composition.

5: However, market gardening demands much more labour: 1 FTE can cultivate 0.14 hectares.

Table 1: Distribution of farms by equipment level and crop system

Equipment levels	Crop combinations				
	Only rainy season rice	Rainy season rice + off-season rice	Rainy season rice + market gardening	Rainy season rice + off-season rice + market gardening	Total
Hand tools	9 %	13 %	11 %	16 %	49 %
Animal traction	6 %	6 %	4 %	16 %	39 %
Mechanized	2 %	6 %	1 %	3 %	11 %
Total	**17 %**	**32 %**	**16 %**	**35 %**	**100 %**

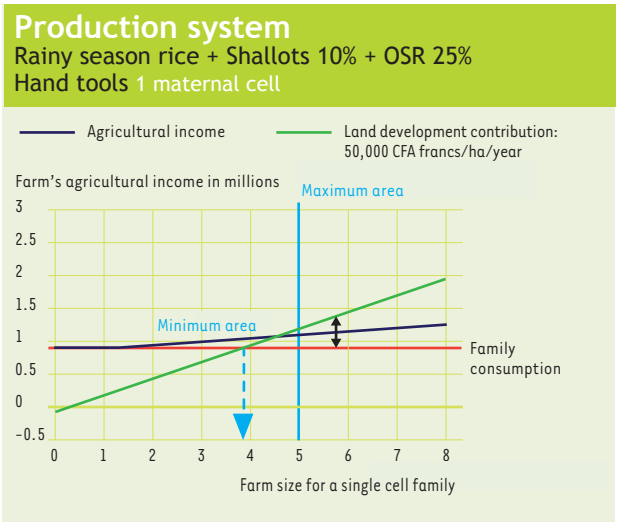
Table 2: family composition and its impact on consumption needs

	% of all family farms	Maximum number of individuals per family	Maximum number of individuals per maternal cell	Maximum number of AWU per family	Maximum number of AWU per maternal cell	Farm's contribution to family consumption per person	Farm's contribution to family consumption
Single families (1 maternal cell : 1 household)	25 %	9	9	5	5	100,000	900,000
Double families (2 maternal cells: 1 household with 2 wives or 2 households with one wife each)	27 %	14	7	8	4	100,000	1,400,000
Triple families (3 maternal cells: 3 households with 1 wife each or 2 households, one with 1 wife and the other with 2 wives or 1 household with 3 wives)	16 %	18	6	9	3	100,000	1,800,000
Large families (> 3 maternal cells)	32 %		5,4		2,75	100,000	Number of cells x 5.4 x 100,000

AWU: Agricultural work unit equivalent to the output of one full-time employee (FTE).

A family farm that only has hand tools should not take on the risk involved in participating in land development financing, even to a lesser extent.

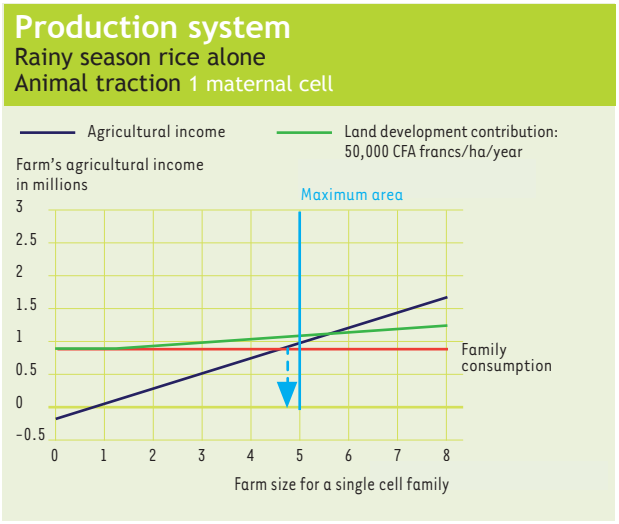
Indeed, even with the most favourable cropping system (100% RSR, 25% OSR and 10% MAR), using hand tools, the study shows that the minimum economically viable farm size (where income and consumption needs intersect) is 4 hectares. However, the maximum cultivable size of a single cell family farm is 5 acres. In the graph, it is clear that with a maximum area of 5 hectares, total investment capacity is almost entirely devoted to land development financing, to the tune of 50,000 CFA francs/year, which leaves the farmer no room for manoeuvre and is therefore too risky. This situation is similar, regardless of family composition and even more unfavourable with any other crop combinations.



Graph 2.

No significant investment capacity can be generated through rainy season rice alone. At least two crops are needed for a family farm in ON to be profitable.

Indeed, the study shows that for a crop system with rainy season rice and draught animal power, the minimum economically viable farm size (intersection of income and consumption needs) is a little less than 5 hectares. However, the maximum cultivable area for a single cell family farm with draught animal equipment is 5 hectares. In the graph, it is clear that with a maximum area of 5 hectares, total investment capacity generated is less than a 50,000 CFA francs/year contribution to land development financing. Therefore no such investment in land development is possible. This situation is similar, regardless of family composition or equipment levels.



Graph 3.

Summary and outlook

Based on the overall results and putting them into perspective according to 60 graphical models, the study drew two general conclusions. Under the following conditions:

- minimum traction equipment;
- farm size closest to the maximum size according to family composition;
- with proper irrigation and drainage.

1) a 100% RSR, 25% OSR and 10% MAR crop system can generate a land development contribution of about 75,000 CFA francs/year (1.5 million CFA francs over 20 years), while maintaining a margin for other investments.

2) a 100% RSR and 10% MAR crop system can generate a land development contribution of about 50,000 CFA francs/year (1,000,000 CFA francs over 20 years), while maintaining a margin for other investments.

In concluding this study, it appears that the pilot land development project suggested by SEXAGON, is economically feasible. Equipped, sized and irrigated as described, half the family farms in ON could meet their own consumption needs, participate in land development financing, repay their loans and continue to make additional investments. To maximize the chances of success of such a project, accompanying measures for family farms must also be implemented, such as access to credit (seasonal, and for equipment and land) and technical/marketing support for family farms and the farmers' organizations to which they belong.

Specifically, "*SEXAGON proposes today that family farmers, thus far beneficiaries of free plots (developed at the expense of the state or donors), now pay a significant property tax for the acquisition of new plots, into an investment fund that is used to finance land development for family farmers. This would encourage the state and donors to expand this type of development more rapidly. In exchange for a payment of such a land tax over a set period of time, farmers would be granted real, secure, assignable and transferable right to exploit the land in question, using a long lease established for this purpose*"[6]. This proposal from SEXAGON includes the following additional elements:

- The development work on plots allocated and delivered to farmers must be fully **completed** (tertiary network and levelling included);
- Irrigated plots that are vacated in their home villages, by farmers receiving new plots, should be allocated to the farmers who remain in the village for the expansion of their farms**, on the same terms** as the plots allocated to the first set of farmers;
- A land agency should be established, to manage the investment fund, to which farmers contribute, and to allocate irrigated plots. Farmers' representatives should participate in the management of the agency;
- **A pilot project** on 2000 acres should be launched to fine tune the proposal and to test its effectiveness;
- The financing offered by SOS Faim's **FAIR programme** with the backing of the Ministry of Foreign Affairs [of Luxembourg] and the DGD [Belgian international development agency] should be available to fund this pilot project.

The next phase of this "Investor farmers" feasibility study will look at legal concerns relating to land development and put SEXAGON's proposals to the test by answering questions such as:

- What type of lease would suit a farmer awarded a plot? Is an emphyteutic lease [which obliges the leaseholder to make improvements to the property] most suitable? Would it constitute a solid mortgage security? What conditions would apply?
- Does the existing legal and regulatory environment, including the Décret de Gérance de l'Office du Niger, allow for the granting of a emphyteutic lease (or other secured usage right) to family farmers who pay a land development contribution? Failing this, what possible rereading of the Décret de Gérance[7] would provide a solution?
- What improvements are already scheduled in Office du Niger, which might accommodate, in one or more phases, this pilot project proposed by SEXAGON?
- What are the criteria for selecting the farmers who will participate in this pilot project?
- How should payment be organized of the land tax which farmers put into the investment fund to be constituted for this purpose?
- What form and operating rules should be given to the land agency, which will be co-managed by farmers and responsible for managing the fund?

A subsequent publication will present answers to all these questions.

6: From the final report of the feasibility study of the SEXAGON proposal «Investor farmers», written by Benoît Dave and Marcel Mazoyer, and supervised by Laurence Roudart, April 2012.

7: The Décret de Gerance defines the main rules of water and land management, establishing the different types of land status.

This issue of Farming Dynamics was written by Christophe Brismé, Partnership Manager of SOS Faim in Mali, based on a study conducted in 2012 by Benoît Dave (researcher at the Centre d'Etudes de la Coopération Internationale et du Développement (CECID) of the Université libre de Bruxelles), assisted by Mamadou Coulibaly (Sexagon researcher), and supervised by Laurence Roudart (professor at the Université libre de Bruxelles) and Marcel Mazoyer (professor emeritus at AgroParisTech).

SOS Faim and the farmers' organizations

For several years, SOS Faim has supported different farmers' organizations in Africa and Latin America. SOS Faim publishes *Farming Dynamics* which deals with the development challenges faced by agricultural producers' and farmers' organizations.
This publication is available for download in French, English and Spanish on SOS Faim's website: *www.sosfaim.org*.

Apart from *Farming Dynamics*, SOS Faim publishes ***Zoom microfinance*** as with all development tools, we have to analyse the aims, models and implementation conditions of aid to microfinance institutions. It is with this purpose in mind that Sos Faim publishes *Zoom microfinance*.

This publication is also available for download in French, English and Spanish SOS Faim's website: www.sosfaim.org.

SOS Faim – Agir avec le Sud

Rue aux Laines, 4
B-1000 Brussels - Belgium
Phone: 32-(0)2 511 22 38 **Fax:** 32-(0)2 514 47 77
E-mail: info.be@sosfaim.org

SOS Faim – Action pour le développement

88, rue Victor Hugo
L-4141 Esch-sur-Alzette - Luxembourg
Phone: 352-49 09 96 **Fax:** 352-49 09 96 28
E-mail: info-luxembourg@sosfaim.org

Editor: Freddy Destrait, rue aux Laines 4, B-1000 Brussels (Belgium).
Coordinator: Marine Lefebvre
Graphic design: www.marmelade.be
Farming Dynamics is printed on recycled paper

Web site **www.sosfaim.org**

Farming Dynamics is produced with the support of the Belgian General Direction of International Cooperation and the Ministry of Foreign Affairs in Luxembourg.

The most recent issues of«Farming Dynamics» have dealt with the following topics:

n° 26
West African farmers' platforms and international solidarity organisations from the North come together to influence ACP-EU Joint Parliamentary Assembly policies

n° 25
FUCOPRI : a Nigerien farmers' organisation that pioneered access to banking services

n° 24
How can family farms feed senegal?

n° 23
MOORIBEN: the experience of a system of integrated services for Nigerien farmers

n° 22
Realising the value of information in agriculture, the challenge taken up by Cameroonian periodicals *La Voix Du Paysan* (LVDP) and *The Farmers' Voice* (TFV)

n° 21
The development of the potato production chain in the Sahel Belt