Land Use Policy 60 (2017) 313–323

Contents lists available at ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Land policy, family farms, food production and livelihoods in the *Office du Niger* area, Mali

Laurence Roudart*, Benoît Dave

Center for the Study of International Cooperation and Development, Université Libre de Bruxelles, avenue Franklin Roosevelt 50, 1050 Bruxelles, Belgium

ARTICLE INFO

Article history:
Received 11 November 2015
Received in revised form
11 September 2016
Accepted 23 October 2016

Keywords:
Farming system
Smallholder land investment
Food production
Land grabbing
Policy scenarios
Mali

ABSTRACT

The objective of this paper is to analyze: 1) the policy conditions under which family farms in the *Office du Niger* area could invest in land; 2) the impacts of various scenarios of land and other policies; 3) the opportunity costs of allocating land and irrigation water to players other than family farmers. A thorough field survey, based on the concept of farming system and combining quantitative and qualitative methods of data collection and processing, was carried out in 2011 involving 380 family farm managers. Models were elaborated from the numerical data. Results indicate that family farmers could invest in land under the following conditions: that they possess an animal-drawn or a motorized piece of equipment, engage in at least one dry-season crop, obtain relatively high yields and have access to irrigated areas more extensive than in 2010. To meet these conditions, proactive policies, pertaining to land, irrigation, credit and inputs are required. Allotting new irrigated land to family farmers could, according to one policy scenario, lead to the creation of tens of thousands of farm jobs and livelihoods. This could, according to another scenario, lead to hundreds of thousands of additional tonnes of rice, thereby exceeding the threshold of grain self-sufficiency. Thus, the opportunity costs of allocating land and irrigation water to investors other than farming families are particularly high.

1. Introduction

Following the surge in agricultural commodity prices on international markets in 2007/2008, many governments questioned the relevance of pursuing a strategy of procurement on international markets in order to ensure food security in their own countries. Many nations then initiated policies to boost domestic agricultural production (Bricas and Daviron, 2009). Meanwhile, agri-food firms sourcing on these international markets were also led to question the security of their supplies. There ensued a major development of large-scale land acquisitions, by firms, transnational or not, by sovereign funds and by other types of players, foreign or domestic (Anseeuw et al., 2012; White et al., 2012; Land Matrix, 2014; Gironde et al., 2015). Beyond the debates about their causes and consequences, these events have revived the substantive debate about the social type of farm – family, capitalistic, cooperative, or other – best able to ensure food security, rural development and a reduction in poverty (Sourisseau, 2014). In this perspective, De Schutter (2011) advocates an assessment of the opportunity costs of allocating land, and irrigation water where applicable, to new investors rather than local peasant families.

The case of Mali sheds particular light on these debates. Indeed, as early as the beginning of the new century, the government of that country sought to attract new land investors. In 2006, it enacted a Farm Bill which did recognize the existence and the expertise of family farms, but which also facilitated allocations of land to new players (Assemblée nationale de la République du Mali, 2006), especially in the *Office du Niger* area (hereafter referred to as ON). This area, located more than 200 kilometers northeast of Bamako, in the inner delta of the Niger River, comprises about 98,000 ha of irrigated land. At the present time, it is cropped almost exclusively by family farmers (Bélières et al., 2011): they cultivate rice in the wet season (June-October) on all the irrigated land, rice in the hot dry season (February-June) on nearly 20% of this land, and vegetables (mainly shallot and also tomato, okra, sweet potato) in the cold dry season (November-March) on about 5% of this land (Bélières et al., 2003; Samaké et al., 2008; Dave et al., 2012). In addition, a large plantation of sugarcane, of 6400 ha, employs wage workers (Sangaré, 2010). This area is considered as the rice bowl of Mali since it alone provides about 45% of national rice production and supplies other parts of the country (Kuper et al., 2002; Cissé et al., 2012).

* Corresponding author.
E-mail address: Laurence.Roudart@ulb.ac.be (L. Roudart).

http://dx.doi.org/10.1016/j.landusepol.2016.10.029
0264-8377/

The policy of attracting new investors to this region was motivated by the budgetary constraints of the State, which does not have sufficient funds to finance new irrigation facilities. It was also based on the assumption that the new investors would be better able to increase agricultural production than existing family farms (Oakland Institute, 2011). At the end of 2011, nearly 600,000 ha of undeveloped land, an area six times larger than that which is at present irrigated, were allocated to new players (Hertzog et al., 2012). Yet, even though estimates of the irrigable area vary from one author to another, all agree that such a large area cannot be irrigated all year round given the limited capacities of the present irrigation system (Sangaré, 2010).

In this context, which it considered uncertain and threatening, the Union of Farmers of the *Office du Niger* (*Syndicat des exploitants agricoles de l'Office du Niger*, SEXAGON) put forward proposals to reform access to land in this area. The SEXAGON (2010) notes that the areas cropped by family farmers are generally too small to meet the basic needs of families, that their access to land (usually through an annual lease, renewable by tacit agreement) is insecure, that new publicly-funded developments are very few, and that the government favors land allocations to new players promising to invest. Based on these observations, the SEXAGON proposes that family farmers, hitherto beneficiaries of their plots on payment of a single hydraulic tax, should make in addition a significant annual contribution for the allocation of *new* plots. This contribution would feed into an investment fund aiming to finance new facilities for family farmers, hence the name of this proposal, "Investor Peasants". In exchange for this payment, limited in time, farmers would have access to new plots via a secure emphyteutic lease, transmissible to their heirs, that could be mortgaged in order to obtain credit (SEXAGON, 2010; Dave et al., 2012; Keita, 2012).

This paper is based on a study carried out at the request of the SEXAGON, which wished to have a systematic evaluation of the investment capacities of different family farm types. It also aims to test various scenarios of land policy combined with other policies, by assessing their impacts on agricultural employment, on livelihoods, on rice production and on rice marketable surpluses. This is tantamount to assessing the opportunity costs of allocating land and irrigation water in the area to investors other than farming families (De Schutter, 2011).

2. Concepts, field survey and models

2.1. Concepts

The characterization of family or peasant farming has been the subject of numerous publications over the past few decades (Chayanov, 1986; Shanin, 1973; Mendras, 1976; Lamarche, 1991). On the occasion of the proclamation by the United Nations of 2014 as the international year of family farming, reflections on this subject have been deepened and updated. Following Garner and O Campos (2014), we define the family farm as an agricultural production unit "which is managed and operated by a family and predominantly reliant on family labor both women's and men's. The family and the farm are linked, coevolve and combine economic, environmental, reproductive, social and cultural functions". Thus, all or almost all of the agricultural work is carried out by the farm manager and members of his/her family; occasional use of temporary employees is possible but there is no permanent employee. And the structural links between the family and the production unit are materialized especially by "the inclusion of productive capital in the family patrimony and the combination of domestic and productive logics, market and nonmarket" (Bélières et al., 2014). This definition is compatible with the wide variety of family farms in the real world.

The definition of peasant agriculture has not reached a consensus. However, for many authors, it is a type of family farming in which a large share of the production is intended for personal consumption and a large proportion of inputs is produced on the farm itself, hence a large degree of autonomy vis-a-vis marketing channels upstream and downstream (Van der Ploeg, 2013).

In the ON, as in most other rural areas in developing countries, farmers combine farm and non-farm activities (Chambers and Conway, 1991; Ellis, 2000; Davis et al., 2010; Haggblade et al., 2010). Even though farming activities are by far the more important while non-farm activities are generally rather unproductive (Bezu and Barrett, 2010; Losch et al., 2012; Sourisseau et al., 2016), all these activities may contribute to the farm's investment capacity, provided that the incomes they generate are controlled by the farm manager. Thus, in the calculation of this investment capacity, we did not take into account the activities carried out by and for individuals or sub-groups within the family, as they do not contribute to the investments made in favor of the family farm as a whole (Ancey, 1975; Gafsi et al., 2007). But we took into account all the activities, farm and non-farm, carried out on behalf of the entire family. These farming activities are under the responsibility of the family head (usually the oldest married man) who organizes them, pays for the related expenses and controls the use of the products. We apprehended these by recourse to the concept of *farming system*, conceived as the combination of production factors (land, labor, equipment, farm buildings) and production activities (vegetal and animal) on a farm (Colin and Crawford, 2000; Gafsi et al., 2007; Darnhofer et al., 2012). We also used the concept of farming system in a broader sense, that of a category of farm, a category being defined according to two criteria, namely the nature of farm equipment, and the combination of production activities (Mazoyer, 1963).

We call *family farm income* the annual income accruing to the agricultural activities of the whole family. This income is based on the *net* added value, from which wages paid to hired workers, land rents, interest on capital borrowed to buy equipment as well as the hydraulic tax are subtracted. We call *family income* the sum of the family farm and non-farm incomes. And we call *land investment capacity* the difference between the family income and the value of consumption needs supported by the family head (see below).

To evaluate these variables, the concept of farming system was used in a thorough field survey that we shall now present.

2.2. Field survey

This survey combined quantitative and qualitative methods of data collection and processing (Marsland et al., 2000; Kanbur, 2003). It relied mainly on a questionnaire intended for farm managers and including both closed-ended and open-ended questions regarding the farming system and the other activities carried out by family members. This questionnaire was administered in February and March 2011, by ourselves and by 12 interviewers trained for this purpose. It was used with 380 farm managers (and other family members when the farm managers could not provide information about these members' activities), in 19 villages: in each village, 20 farm managers were selected randomly.[1] The villages were spread over 5 out of the 6 sectors of the ON so as to capture the diversity of ecological and social conditions within this area. They were also chosen so as to represent various levels of prosperity, this depending especially on the location vis-a-vis the irrigation system. Each of the 380 interviews produced detailed technical and eco-

[1] Initially, the questionnaire was used with 400 farm managers in 20 villages. But, during data processing, it appeared that the random selection had not been respected in one village, which was then removed from the sample.

nomic information on farm production factors, crop management, from soil preparation to post-harvest, livestock management from birth to sale or slaughter, utilization of the farm produce (personal consumption, sale, seed reserves. . .), as well as on other revenues and costs. Some of the data thus collected are numerical (yields, input quantities, etc.) and constitute a data base of approximately 140,000 items. Other data are qualitative and relate primarily to the reasons that farmers put forward to explain their practices. The number of interviews allowed us to reach and even go beyond saturation, in the sociological sense, for each farming system category.

As these interviews were fairly lengthy (2 h on average), questions about the family's consumption needs borne by the family head were not included at this stage. A specific survey devoted to this issue was conducted afterwards, with 60 out of the 380 farm managers previously interviewed. These 60 farm managers were located in 3 villages spread over 3 sectors of the ON.

2.3. Models

2.3.1. Farming systems, family types, non-farm incomes and consumption needs

As mentioned earlier, the family farms surveyed were classified according to the nature of the equipment and the combination of production activities (Table 1). This table shows that half of the farmers own only manual equipment, that all of them cultivate rice in the wet season, that two-thirds grow rice in the dry season and that half of them grow vegetables in the dry season. In addition, in each category, farmers may raise small flocks of sheep or poultry within domestic compounds, or cattle in the bush, the latter kind of livestock being rare on farms with manual equipment only. Goat rearing also exists but it is uncommon.

Peasant families are complex entities in this area: they can include between 1 and 10 households, each one usually being headed by a man; as a man can have up to four wives, each household has between 1 and 4 maternal cells: we call maternal cell the group formed by a mother and her children, which corresponds to the phrase *baa-bôdâ* in the Bambara language; lastly, each maternal cell comprises between 0 and 10 children. Thus, a peasant family can comprise from 2 to over 100 persons. The collected data led us to identify eight family types according to the number of maternal cells: from 1 to 8.

Non-farm incomes come from activities such as petty trade, craftsmanship (tailoring, blacksmithing, carpentry. . .), fishing, etc.

According to the results from the specific survey, the consumption needs supported by the family head average 100,000 CFA Francs (CFA F) per person and per year[2]: nearly half of this value is devoted to food cereals, almost 20% to other foodstuffs (vegetables and other condiments accompanying cereals), and the remaining third to non-food needs (clothing, school, health, transport, firewood, electricity, home care, other).

2.3.2. Modelling family income and investment capacity

For each farming system category cum family type, we developed an empirical descriptive model representing the variation in the family income (see above) according to the area cultivated by the family (Fig. 1). The family income results from the sum of the farm and non-farm incomes. As for the farm income, according to the averages emanating from our sample, all models assume that 100% of the farm area is grown with rice in the wet season; for models including dry-season rice, the area under this crop is set at 25% of the farm area; for models with dry-season vegetables, the chosen vegetable is shallot because it represents three-quarters of the area under vegetables, and its area is set at 10% of the farm area. The non-farm incomes do not depend on the area cultivated. They are added to the farm income as a lump sum, which is the aver-

[2] Using the 2010 average exchange rate of 492 CFA F/USD, 100,000 CFA F correspond to 203 USD.

Table 1
Farming system categories, proportions and numbers of observations (in parentheses) in the sample.

Crop combination	Equipment type			
	Manual	Animal-drawn	Motorized	TOTAL
Wet-season rice only	9% (34)	6% (23)	2% (7)	17% (64)
Wet-season rice and dry-season rice	13% (23)	13% (49)	6% (23)	32% (121)
Wet-season rice and dry-season vegetables	11% (42)	4% (15)	1% (5)	16% (62)
Wet-season rice and dry-season rice and dry-season vegetables	16% (61)	16% (61)	3% (11)	35% (133)
Total	49% (186)	39% (148)	12% (46)	100% (380)

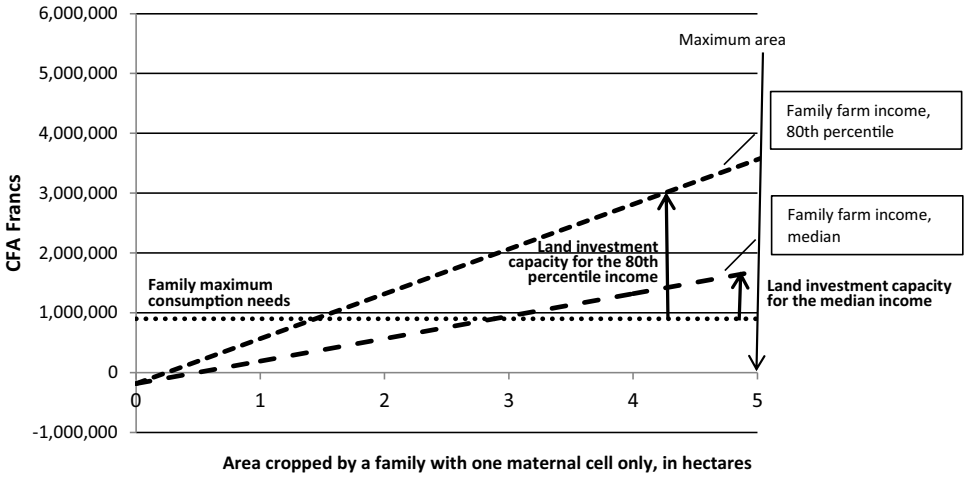

Fig. 1. Family Income and Family Consumption Needs Depending on the Cropped Area.

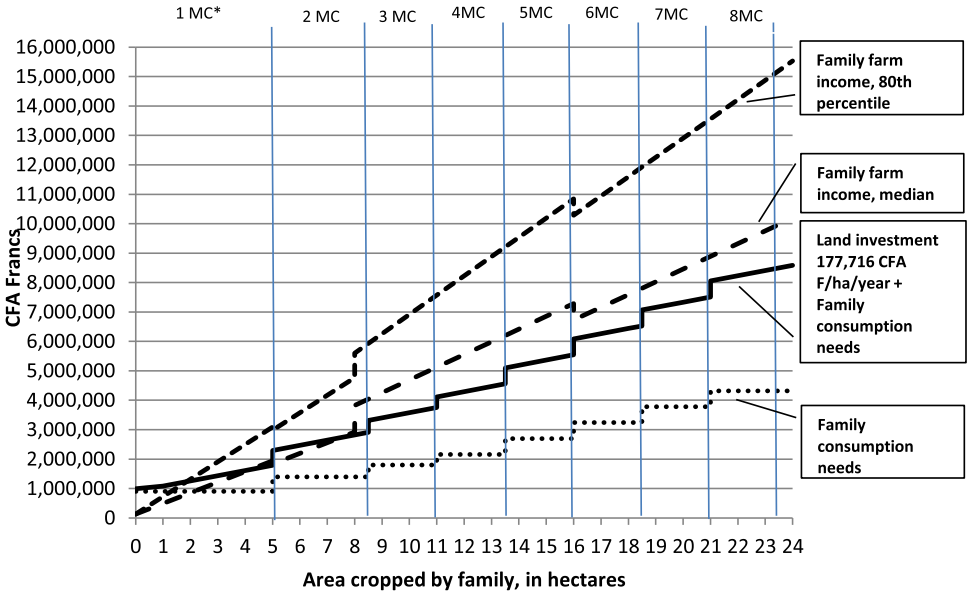

Fig. 2. Family Farm Income, Consumption Needs and Land Investment of 177,716 CFA F/ha/year for the Crop Combination "wet-season rice, dry-season rice and dry-season vegetables".
*1MC: 1 maternal cell
Assumptions: the equipment is animal-drawn up to 8 ha and is motorized beyond, as the latter becomes more profitable than the former above this area; it is necessary to invest in a new power tiller every 8 ha, hence a decrease in the net added value at 16 ha; similarly, it is necessary to invest in a second animal-drawn piece of equipment at 5 ha, and to buy a set of manual equipment for each additional maternal cell (which is not visible given the graph scale).

age of these incomes for the farming system category considered, weighted by the proportions of farms receiving these incomes.

The family income appears at two levels: median and high (80th percentile of our sample) (Roudart, 2001). Indeed, the farm income depends on the area cropped but also on yields and product prices. Regarding rice for instance, the yield is higher where access to irrigation water and inputs is optimum, and where soil preparation takes place at the right time; and those farmers who are able to store their rice after harvest can sell it later on at higher prices.

Fig. 1 also shows the value of the *consumption needs* of the family, assuming that these needs are at their highest level given the demographics of the family (Chayanov, 1986). The *maximum area* that the family workers can cultivate is determined by the maximum number of agricultural workers and by the type of equipment used. The vertical distance between the family income and the value of consumption needs, since the former is higher than the latter, can be interpreted as the land investment capacity. Indeed, the farm income calculation already takes into account investment in equipment (see above). One should note, however, that the difference between the family income and the value of consumption needs could also serve to purchase more inputs or to increase family consumption.

These models can be used to perform simulations, particularly by varying the cropped areas or the rice yields (wet-season or dry-season).

3. Results

3.1. Conditions of economic feasibility of smallholder land investment

From our survey results, 16% only of family farms actually generate an investment capacity under current conditions of production. According to the farmers interviewed, the main reason for this low proportion is the very small irrigated area per farm. Indeed, from our survey, the average area per farm is only 3.8 ha, or 0.22 ha per person, which means that the vast majority of family farms have a much smaller area than that they would actually be capable of cropping, even smaller than what would be required to meet the basic needs of the family. According to the respondents, the other important factor limiting their investment capacity is the insufficient access to credit to acquire means of production, whether this is short-term credit to buy inputs in order to increase yields and extend the dry-season crops, or medium-term credit to buy an animal-drawn or a motorized item of equipment and thus increase yields (thanks to improved soil tilling).

3.1.1. Land investment capacity without subsidy

We used our models to test the ability of family farms to invest in land if these constraints were lifted. Fig. 2 shows the results of this analysis for those farming systems including the crop combination "wet-season rice, dry-season rice and dry-season vegetables". Fig. 2 has been drawn up according to the principles explained above for Fig. 1, while including the 8 family types (1 to 8 maternal cells). Therefore, the consumption needs appear as a stepped line: each additional maternal cell is assumed to be at its demographic maximum. Fig. 2 also includes a second stepped line corresponding to the sum of the value of the consumption needs and of a land investment of 177.716 CFA F/ha/year. This amount corresponds to the constant annual repayment, by ha, of a credit of 3 million CFA F (cost of irrigation development for 1 ha) over 25 years at an interest rate of 3% per year. Note that this figure is used here as a benchmark. It is not to be taken as an argument in favor of family farmers becoming indebted to pay for the land, as the SEXAGON's proposal is that farmers pay an annual contribution to a land investment fund, and not to a moneylender.

Fig. 2 shows that with a median family income, a farming family could generate a land investment capacity from two maternal cells and 8 ha. Below this area, either there is no land investment capacity (up to 2.5 ha), or such a capacity exists but for an amount lower than that considered here. For a family income at the level of the 80th percentile, a farming family could generate a land investment capacity from one maternal cell and 2 ha. Beyond this area, the land investment capacity increases with the cultivated area per mater-

nal cell (this area remaining less than or equal to the maximum surface cultivable with family labor) and with the number of maternal cells. For low levels of family income (bottom two quintiles), there is no land investment capacity.

As for the farming systems including the crop combination "wet-season rice and dry-season vegetables" (see Graph 1 in Supplementary material), the median family income allows for such a high annual rate of land investment between 8 and 16 ha. It also allows for lower land investment from 2 maternal cells and 5.5 ha. With a family income at the level of the 80th percentile, a high annual rate of land investment is possible from 1 maternal cell and nearly 2 ha.

Furthermore, the analysis of farming systems including only one wet-season rice crop showed that the potential investment capacity of these systems is usually not sufficient to envisage any land investment. The same applies to farming systems relying on manual equipment only.

Thus, it appears that farming families in the ON could actually pay for irrigation development costs if the following conditions were met: they must possess one item of animal-drawn or motorized equipment, engage in at least one dry-season crop, obtain yields higher than the 2010 median yields so as to reach a farm income higher than the median income, and enjoy access to irrigated areas larger than in 2010. But, given their current endowments in production factors, which are very modest, the vast majority of family farms in this area cannot afford such a high level of land investment. However, in many cases, an investment lower than the full cost of irrigation development and credit could be undertaken. For this reason, we consider below the case for a public subsidy to irrigation development.

3.1.2. Land investment capacity with a subsidy

This subsidy would cover the interest on the capital borrowed and part of the irrigation development cost. This results in a drop in the farmer's annual land investment compared with Fig. 2. Thus, in Fig. 3 which examines the crop combination "wet-season rice, dry-season rice and dry-season vegetables,the land investment is lowered to 75,000 CFA F/ha/year. In this case, the median family income can reach a land investment capacity from 1 maternal cell and 3 ha. When the family income reaches the 80th percentile, land investment is possible from nearly 2 ha upwards. As for the crop combination 'wet-season rice and dry-season vegetables', a land investment of 50,000 CFA F/ha/year is possible with the median family income for 1 maternal cell beyond 3 ha; it is possible from 1 maternal cell and nearly 2 ha with a family income at the level of the 80th percentile (see Graph 2 in Supplementary material).

3.1.3. Simulations for prices and yields, and for livestock activities

The results presented above are based on the yields and prices observed in 2010. In that year, the average price for rice paid to producers (238 CFA F/kilo) was below the average for 2008 and 2009 (275 CFA F/kilo) but above the average for 2005 to 2007 (214 CFA F/kilo). The price of the mineral fertilizer bought by producers was relatively low, at 12 300 CFA F per bag of 50 kilos instead of 21 650 CFA F, due to a subsidy established by the government following the surge in food prices on international markets in 2008. And the average yield of the wet-season rice, at 3.2 t per ha, was below its usual range, which is between 3.4 and 3.7 t per ha, but not at its lowest level as in 2003 (Dave, 2007).

Under these conditions, we performed several simulations unfavorable to land investment capacity, so as *not* to overstate this capacity: a 10% decline in the rice price, the removal of the subsidy on fertilizers, a 10% decline in the rice yield. The results of these simulations are not markedly different from those presented in Figs. 2 and 3: the minimum areas above which the family farmers could invest in land are just a little higher.

Conversely, when livestock activities are added to the cropping activities within the farming system models, the farm incomes increase and the minimum areas above which the family farmers could invest in land are lower.

Finally, for a large number of family farms in the ON to be in a position to pay for land investment, proactive policies are needed: a land policy aimed at expanding the irrigated areas allocated to these farms, a medium-term credit policy to equip them with

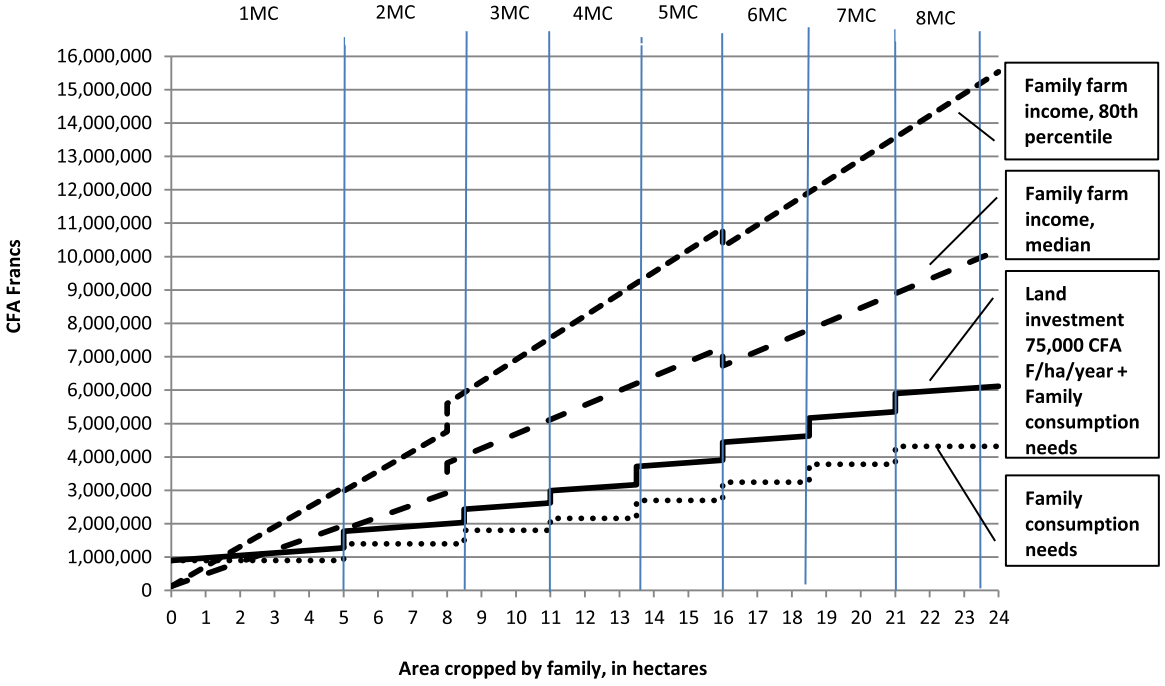

Fig. 3. Family Income, Consumption Needs and Land Investment of 75,000 CFA F/ha/year for the Crop Combination "wet-season rice, dry-season rice and dry-season vegetables".

animal-drawn or motorized equipment in proportion to their areas, a short-term credit policy cum quality inputs (seeds, fertilizers) supply policy to achieve relatively high yields, and a water policy directed at the proper maintenance of the irrigation and drainage systems in order, again, to obtain relatively high yields. In several official documents, the Government of Mali did declare its desire to expand irrigation facilities and to improve water management in the ON (République du Mali, 2012), and also to "establish a genuine agricultural credit system adapted to the needs of the different farmer categories" (République du Mali, 2013a). Based on the calculations presented above, we assess in the next section the impacts of different such policy scenarios.

3.2. Various land and other policy scenarios

3.2.1. Overview of scenarios

Scenarios 1 to 3 presented below are consistent with the prospect of allocating new irrigated land to family farms. They aim to assess the impacts of different policies on farm employment, on livelihoods, on rice production and marketable surpluses. This is equivalent to assessing, for these variables, the opportunity costs of allocating new irrigated land to new investors rather than to peasant families (De Schutter, 2011).

Scenario 0 corresponds to the situation in 2010. It assumes that the proportions of farming system categories and of family types in our sample are valid for the whole set of farms in the ON, and that there are 24,000 farming families in total (total irrigated area minus the sugarcane plantation area, divided by the average farm area established by our sample).

The other three scenarios assume extensions of the total irrigated area during the wet season. Conversely, they assume that the dry-season irrigated area remains the same as in 2010. Indeed, during this season, present water withdrawals for irrigation of the ON already barely make it possible to maintain a proper flow for downstream populations (40 cubic meters per second downstream of the dam at Markala) in years of average rainfall. And these withdrawals mean that it is not possible to meet this tacit standard in dry years (Schüttrumpf and Bökkers, 2008). The availability of water during this season could increase with the construction of the Fomi dam in Guinea, but this construction remains very hypothetical. The relative proportions of farming system categories change accordingly as compared with 2010 but the proportions of family types remain the same as in 2010.

Each of these scenarios has two variants. Variant A combines a land policy of allocating new irrigated land to family farms with a medium-term credit policy allowing farmers to buy the animal-drawn or motorized equipment proportionate to their land. In this variant, the availability of short-term credit, of inputs and of irrigation water remains the same as in 2010. Conversely, in variant B, proactive policies of short-term credit, of supply of quality inputs and of good maintenance of the irrigation and drainage networks enable farmers to achieve rice yields equal to those of the 80th percentile in our 2010 sample; in this variant B, land policy and medium-term credit policy are the same as in variant A.

3.2.2. Specificities of scenarios and results

These scenario results are reported in Table 2. Scenarios 1 and 2 are predicated on the assumption that the irrigated area is extended to 134,000 ha in the wet season (as against 98,000 ha in 2010), which is the maximum area possible considering the current carrying capacity of primary irrigation canals (Sangaré, 2010).

Scenarios 1A and 1 B assume that the additional irrigated land is allocated to *new* farming families, originating from regions other than the ON. These scenarios therefore do *not* fit into the logic of the "Investor Peasants" proposal, which postulates that the largest possible number of farming families already present in the ON should enjoy access to more irrigated land. These scenarios result in 35,000 farming families, which is more than 560,000 people, having access to a means of livelihood. As these families have to sell rice to meet their non-food needs, and as they are more numerous than in scenario 0, the marketable rice surplus is higher in scenario 1A than in scenario 0. *A fortiori*, it is even higher in scenario 1B, with relatively high rice yields.

Scenarios 2A and 2 B are consistent with the logic of the proposed "Investor Peasants" scheme. As they fall within the constraint of a maximum irrigated area of 134,000 ha in the wet season, they do not allow all the existing family farms to expand their areas to the maximum which their available family labor would permit. This is why these scenarios assume that such an expansion concerns 10% of the farms with manual equipment, 38% of the farms with animal-drawn equipment, and all the farms with motorized equipment. All enlarged farms are supposed to be endowed with animal-drawn equipment below 8 ha and with motorized equipment beyond 8 ha, which supposes credit policies and possibly provision policies for this equipment. These scenarios provide livelihoods for the 24,000 farming families existing in 2010, that is, close to 390,000 people, and scenario 2A allows the creation of a marketable rice surplus representing about 1.6 times that of 2010 with the same yield levels.

Scenarios 3A and 3B also conform to the logic of the "Investor Peasants" proposal. But they assume that 100% of family farms in 2010 reach the maximum area permitted by their family labor availabilities, and that all farms are endowed with animal-drawn equipment below 8 ha and with motorized equipment beyond 8 ha which, again, requires appropriate credit-cum-equipment policy measures. This involves an enlargement of the irrigated area to about 225,000 ha, which is lower than the various estimates of the irrigable surface in the wet season: 319,000 ha (Couture et al., 2002), 600,000 ha (Schüttrumpf and Bökkers, 2008), one million ha (Traoré, 2008). Note that this figure of one million ha was already being advanced in the 1930s by the French initiators of irrigation in this area. However, most authors believe it to be unrealistic in view of the variability of the river flow and the water needs downstream of the zone, including those of other riparian countries (Couture et al., 2002). These scenarios would require an enlargement of primary irrigation canals. They would lead to a considerable increase in the marketable rice surplus, so much so as to ensure the grain self-sufficiency of Mali in 2010 conditions, and even to turn it into an exporting country.[3]

3.2.3. Opportunity costs

From these scenarios, we can assess the opportunity costs resulting from the non-allocation of *new* irrigated land to family farms, in terms of farm jobs, of livelihoods in the ON, of rice production and marketable surpluses For this purpose, we take the values of these variables for each scenario 1 to 3, and we subtract from them the values obtained with scenario 0 (we thus assume that the irrigated land currently cropped by peasants continues to be cropped by them, and that it is therefore *not* allocated to new investors). Table 3 shows that these opportunity costs are very high: they number in the tens of thousands of agricultural jobs and livelihoods in the case of scenario 1; and they represent hundreds of thousands of tonnes of rice production and marketable surplus, so much so that the opportunity could be lost of achieving a situation of grain self-sufficiency and even of grain exports.

[3] According to FAO (2016), Mali imported an average of 272,000 t of cereals each year from 2009 to 2011, that is 412 000 t of paddy (unhusked rice)-equivalent. For the ON to have led Mali towards cereal self-sufficiency in 2010, it would have had to produce a paddy surplus of 223,000 t (surplus in 2010) plus 412,000 t (imports of paddy-equivalent in 2010), that is a surplus of about 635,000 t. Mali imports around 5% of its cereal consumption needs (FAO, 2016).

Table 2
Impacts of various land and other policy scenarios in the *Office du Niger* area.

	Scenario 0	Scenario 1A	Scenario 1B	Scenario 2A	Scenario 2B	Scenario 3A	Scenario 3B
	Baseline situation in 2010	Farm areas as in 2010		Maximum areas for part of the farms, given family labor in 2010		Maximum areas for 100% of farms, given family labor in 2010	
Total cropped area (ha)	91,600	134,000	134,000	134,000	134,000	225,347	225,347
Number of family farms	24,000	35,000	35,000	24,000	24,000	24,000	24,000
Average area per farm (ha)	3.8	3.8	3.8	5.6	5.6	9.4	9.4
Number of people living on farms	388,128	566,021	566,021	388,128	388,128	388,128	388,128
Number of farm jobs (part-time in scenarios 0 to 2, full-time in scenario 3)	201,827	294,331	294,331	201,827	201,827	201,827	201,827
Percentage of "Investor peasants"	0%	0%	0%	31%	31%	100%	100%
Rice production (t)	331,777	461,768	589,341	484,982	609,613	799,147	993,509
Rice personal consumption+ seeds (t)	108,676	158,486	158,486	108,676	108,676	108,676	108,676
Rice marketable surplus (t)	223,101	303,283	430,855	376,306	500,937	690,471	884,833

Table 3
Opportunity costs of not allocating extra land and irrigation water to farming families in the ON.

	Scenario 1A	Scenario 1B	Scenario 2A	Scenario 2B	Scenario 3A	Scenario 3B
	Farm areas as in 2010		Maximum areas for part of the farms, given family labor in 2010		Maximum areas for 100% of farms, given family labor in 2010	
Extra number of people living on farms compared with the baseline situation in 2010	177,892	177,892	0	0	0	0
Extra number of farm jobs	92,504	92,504	0	0	0	0
Extra rice production (t)	129,991	257,564	153,204	277,835	467,370	661,732
Extra rice marketable surplus (t)	80,181	207,754	153,204	277,835	467,370	661,732

We now turn to the discussion of the results presented above.

4. Discussion

This article aims to shed light on the debate about the pros and cons of large-scale farms versus family farms. This debate has several dimensions, amongst them their relative abilities to invest with a view to promoting food security, rural development and environmental sustainability, as well as their compared impacts in terms of creation of jobs and means of livelihood and their compared capacities to ensure agricultural growth and meet the "production challenge". Before addressing these dimensions, we will first discuss the limitations of our research approach.

4.1. Limitations of the present research approach

One limitation of this research pertains to the sample of 19 villages where the survey took place: they are spread over 5 out of 6 sectors of the ON, which means that the Béwani sector is not represented. However, this is a newly developed area, of limited dimensions (less than 10% of the total irrigated area) and with few farms. Another limitation is that the number of interviews is low for 3 farming system categories, with motorized equipment, which may impinge on the reliability of numerical estimates. But this concerns a mere 6% of the farms in the area. Moreover, the total irrigated area of the ON is uncertain, as is the total number of family farms. However, other reasonable assumptions regarding the total irrigated area and number of farms lead to results in the same order of magnitude. Another point is that scenarios 1 to 3 suppose an extension of the rice cropland at the expense of land with other uses such as grazing and firewood supply. Yet these resources are gradually becoming less available on account of the increase in the human population and in herds of herbivores, and because of past extensions of rice paddies (Cissé et al., 2012; Nesheim et al., 2014). The development of new irrigated areas should take into account the results of a specific landscape analysis and of an environmental impact assessment. This applies regardless of the type of player investing in land, whether family farmer or other.

On the other hand, several arguments buttress the validity of the results. From a sociological qualitative point of view, the survey reached saturation for each category of farming systems. The study findings were presented to the various players concerned – peasants, NGOs, the *Office du Niger*, the Ministry of Agriculture, donors – who overwhelmingly endorsed them.

4.2. Investments in agriculture and public policies

There is a general consensus as to the need to increase the quantity and quality of investment in agriculture (World Bank, 2007). However, the types of players and of investment that are desirable are subject to debate. Following the financial and food crisis of 2007/08, many financial entrepreneurs have developed a wide variety of products allowing capital holders to invest in farms or in food industries. These entrepreneurs and investors come together especially in international conferences such as "Global AgInvesting", "Ag Innovation Showcase" and the "Terrapin Agriculture Investment Summit" (Du Castel, 2016). Agricultural investment funds have thus developed worldwide, including in Sub-Saharan Africa (FAO, 2010; Silici and Locke, 2013; Crédit suisse et al., 2015). They interest institutional investors such as pension funds, banks, insurance companies, etc. and also public financial development institutions such as the World Bank Group, which consider them as a way to increase the capital invested in agriculture (Banque africaine de développement, 2012).

On the other hand, in their analysis of the total public and private investment in agriculture in 76 low- and middle- income countries, Lowder et al. (2012) show that on-farm investment in agricultural capital is by far the most significant, accounting for more than four times government investment, and many times more than official development assistance and foreign direct investment. Many of the investments made by farmers come from their labor. They take the form of improvements of land and other natural

resources, increases in herds, perennial plantations, construction of farm buildings and tools. On these grounds, the FAO (2012) claims that farmers' investments must be at the core of any strategy aiming to enhance agricultural investment. And the *Principles for Responsible Investment in Agriculture and Food Systems*, which were drawn up under the umbrella of the Committee on World Food Security following a process of consultations including many stakeholders, stipulate that "responsible investment includes priority investments in, by, and with smallholders" (CFS, 2014).

However, smallholders' investments confront many constraints, these being generally related to smallholders' assets, or to markets, or to institutions. This is why governments and donors have a crucial role to play in order to facilitate investments by farmers, particularly by promoting smallholder access to productive assets, including natural assets, and by providing public goods such as infrastructures and public services, with a view to increasing land and labor productivity (FAO, 2012; HLPE, 2013). These analyses are backed by several reports emanating from smallholder organizations, which highlight the importance of infrastructures and of access to inputs for sustainable family farming (PROPAC et al., 2011; EAFF et al., 2013) and which, with a good sense of humor, call for PPPs being Public-Peasant-Partnerships rather than the conventional Public-Private-Partnerships, as "farmers are the private sector" (McKeon and Cissokho, 2013).

The history of agricultural development in many parts of the world in recent decades buttresses these ideas. Indeed, it shows that, with the support of well-conceived policies, family farmers have been able to invest and increase their production and productivity. This was true in Asian countries that implemented green revolution policies from the mid-1960s onward (Hazell and Ramasamy, 1991; Mellor, 1998; Trébuil and Hossain, 2004; Griffon, 2006). It was true also in North America from the 1930s and in Western Europe from the 1950s (Mazoyer and Roudart, 2006; Weis, 2007). Certainly, since the 1980s, with the dominance of the Washington Consensus, many agricultural policies have been dismantled (Roudart, 2008). However, according to Chang (2012), "the failure of the Washington Consensus recipe has been particularly severe in the agricultural sector". His review of the agricultural policy challenges faced by today's rich countries in the past, and by poor countries today, shows that the challenges we have identified for the ON – insufficient access to irrigated land, to credit, to fertilizers, and the poor quality of these – have been common. The policy measures which allowed these challenges to be faced successfully have varied according to country and time, but they may be summed up as follows. First, State provision and subsidization of irrigation as a public good, and distribution of land to small farmers. Second, accompanying measures to raise production and productivity on small farms: the supply of (subsidized) inputs (fertilizers, machinery, irrigation water) and public regulation of fertilizer quality; subsidized credit delivered by specialized rural banks controlled and supported by the State. It is well known that the record of state-controlled agricultural credit in developing countries is mixed. As Chang (2012) puts it, "subsidized credit does not guarantee agricultural success. However, agricultural success without it is impossible to achieve". Several smallholder organizations consider that access to credit in easier conditions is indeed essential to enable family farmers to invest (EAFF et al., 2013).

Our study is part of this perspective. It starts from the observation that, in the ON as in many other regions where large-scale land acquisitions have taken place recently, vast tracts of the acquired lands are not "invested" and remain idle (Anseeuw et al., 2012; Adamczewski-Hertzog et al., 2015; Land Matrix, 2016). This was true in the ON even before the political unrest that began in 2012: indeed, in 2011, 2% only of the newly acquired land was cropped, mainly through family farming (Adamczewski et al., 2011; Burnod et al., 2011). At the request of the SEXAGON, our study has identified the constraints on smallholders' investments that are specific to this area, and assessed the investment capacities of different types of family farms if these constraints were lifted. And, drawing on the rich history of agricultural policy interventions in developed and in developing countries, it proposes policy measures that could remove these constraints to peasant investment.

Let us now move on to the discussion of policy scenarios as regards their impacts on job creation and livelihoods.

4.3. Demography, job creation and livelihoods

According to the demographic projections of the United Nations, the global labor force will increase by 1.4 billion people between 2010 and 2050, more than half of them (760 million) in Sub-Saharan Africa (United Nations, 2011). This continent has two major characteristics regarding demography: the annual cohorts of young people looking for their first job will increase sharply until 2050 and beyond, reaching 36 million people per year in 2050; and the rural population will continue to grow, by 57% between 2010 and 2050 (Losch, 2012). Yet, on this continent, the structural transformation of national economies (Timmer, 2009) has generally made little progress: the shares of agriculture in employment and GDP remain high, as is the share of the rural population in the total population, and non-farm rural households are rare. Moreover, even if farming family members engage in non-farm activities, these usually generate very low incomes and more often form a survival strategy rather than a positive diversification strategy (Losch et al., 2012). As a result, real job opportunities are scarce apart from in agriculture (Weis, 2007; Hathie et al., 2015) and this will inevitably continue in the short and medium run. Even in the long run, agriculture could continue to contribute significantly to employment because it is unlikely, and undesirable as regards sustainability, that the structural transformation of economies will take place in Sub-Saharan Africa as happened in Europe and in East and Southeast Asia (Byerlee et al., 2009; Losch et al., 2012). These analyses echo what some critical agrarian political economists call the "agrarian question of labor": the globalized capitalist system does not produce enough stable jobs, with a living wage, for all those who need them; for those who survive by means of precarious and low-paid activities, access to land can be part of their survival strategy (Bernstein, 2009).

Mali illustrates these demographic trends and the need to create many agricultural jobs, except at the risk of leading to major social instability. In this country, the population's natural growth rate has been very high, higher than 3% per year since the late 1990s. This is due to a fertility rate among the highest in the world, over 6 children per woman, and a decline in mortality rates, especially among children under 5 years of age. In addition, the population is young: two thirds of Malians are under 25 years old. As a result, the working population will double by 2035 (United Nations, 2015). In this context, the Government of Mali declared "job creation and the reduction of rural-urban migration" to be among the main objectives of its agricultural development policy (République du Mali, 2013b).

According to Sourisseau et al. (2016), in the Segou region which includes the ON, 85% of the workforce falls within the primary sector, and 6% only of rural workers are engaged in non-farm activities. They conclude their report by calling upon the public authorities to install family farms in the ON (p. 129) and to promote there the development of small and medium-sized enterprises upstream and downstream of agricultural production in order to create jobs and added value, among other actions. Yet, in the ON, as a result of demographic growth, the irrigated area per farm has been declining continuously over the past decades, so much so that Bélières et al. (2011) state that access to enough irrigated land is "the main challenge for the future of family farming in this area".

The investment strategy considered in this article aims to reverse this trend. It is meant to be realistic because many declarations in the past promised that the irrigated land would be much extended, without further action being taken. Therefore, it takes into account the constraint of 134,000 ha, beyond which the primary channels will have to be enlarged, and the fact that moving to 225,000 ha of irrigated land (from 98,000 ha in 2010) would already be a notable achievement. It also takes into account the present constraint on water availability during the dry season. The above-mentioned scenarios are intended for present generations. However, as the proposal of the SEXAGON assumes that the beneficiaries of new developed land will contribute to a fund to expand irrigation even more, these scenarios call for further initiatives, with further extensions of irrigated areas to absorb population growth, while taking into account the needs of other users of land and water. Moreover, the strategy considered here assumes that the increase in agricultural income resulting from production and productivity increases will lead to the development of rural non-farm jobs, as happened in Asian regions having implemented the green revolution (Lipton, 2005).

As regards farm jobs, according to our calculations, the farming systems currently implemented by smallholders in the ON provide about 2200 jobs for 1000 ha: the majority are part-time jobs as farm areas are generally smaller than the areas that family members could in fact cultivate. In scenario 3, where farm areas are supposed to be at their maximum given the existing family labor, the farming systems generate 895 full-time jobs for 1000 ha. As very little of the land allocated to large-scale investors over the past 15 years has come into production, and as we could not investigate the sole sugarcane plantation in the area, we cannot compare these figures with the number of jobs provided by large holdings in this area. However, it is possible to put forward plausible orders of magnitude of the number of farm jobs that could be generated by large estates producing rice or sugarcane, which are the two main crops referred to by new investors in the ON (Sangaré, 2010). For large concessions devoted to rice cultivation, the World Bank report *Rising Global Interest in Farmland* (Deininger and Byerlee, 2010) calculates ratios of 26.7 full-time jobs per 1000 ha in Liberia and 45 jobs per 1000 ha in Tanzania, though in the latter case, the report does not specify whether these are full or part-time jobs (p. 157, 160). The same report indicates ratios of 150 jobs per 1000 ha of irrigated sugarcane with mechanized harvesting in Mozambique, and 700 jobs per 1000 ha of irrigated sugarcane with manual harvesting in Tanzania, the share of seasonal jobs, undoubtedly the large majority, not being specified there either (p. 28). The former figure is consistent with what was announced in 2002 for the Sugar Project at Markala in the ON: 5000 direct jobs for 40,000 ha of sugarcane, that is 125 jobs per 1000 ha (Adamczewski et al., 2011). All these ratios are well below 895 full-time jobs per 1000 ha, this result being consistent with other authors' findings for other regions (Li, 2011; Scheidel et al., 2013). Real numbers of jobs created are much lower still. As for the Markala Sugar Project, eight years after its launch, only 140 ha of sugarcane were cultivated, and the project employed 5 persons only (Adamczewski et al., 2011). As for the Malibya project (100,000 ha), no job has been created since the completion of the canal in 2010 (Adamczewski-Hertzog et al., 2015). Beyond farm jobs, the present farming systems combined with non-farm activities provide livelihoods to numerous people, about twice the number of farm workers.

Within a broader perspective, our results support the idea that family farming is much better placed than corporate large-scale farming to provide jobs and livelihoods, through labor-driven intensification (McMichael, 2013; Van der Ploeg, 2013).

4.4. Production, surplus and food self-sufficiency

From the 1980s, the Washington Consensus has promoted policies of international trade liberalization and specialization exploiting comparative advantages (Krueger et al., 1991). In the agri-food sector, these recommendations have been accompanied by a criticism of national strategies for food self-sufficiency and with the promotion of the enlarged concept of food security, which considers that food supply in a country can come from domestic production but also from imports, and food aid if necessary. However, a large number of governments, both in developed and in developing countries, have resisted the idea of depending on foreign staple food supplies. Thus, in the process of negotiating a new Agreement on Agriculture in the World Trade Organization (WTO), which started in 2000, the so-called "Friends of multifunctionality" (South Korea, Japan, Norway, Switzerland) have deemed that all forms of agricultural subsidies are acceptable for the purpose of increasing the level of food self-sufficiency. And the so-called "Friends of the Development Box" have claimed the right to derogate from the liberal rules of the first WTO Agreement on Agriculture (signed in 1994) for "special products" as regards food security and rural development (Roudart, 2008). More recently, following the food crisis of 2007/08, many governments have revived the idea of a high level of food self-sufficiency, on the grounds that the risk of "significant falls in their food import capacities" incurs "the possibility of irreversible damage to a country's productive capabilities, as well as (. . .) obvious human suffering" (Chang, 2012).

Discussing whether Mali has comparative advantages in producing rice, or not, is beyond the scope of this article. Our study takes for granted that the Government of Mali has recently declared its political will to boost agricultural production and to turn Mali into an agricultural exporting power (République du Mali, 2012, 2013a). And this study assesses to what extent the ON could contribute to such objectives in the short and medium run.

How this production challenge can be confronted brings us back to the debate about the kind of players best placed to do so. According to some, only large agricultural commercial enterprises, highly capitalized and technically sophisticated, can play this role, since they attain high levels of productivity and benefit from economies of scale (Collier, 2008). According to others, referring in particular to the Green Revolution in Asia, "smallholders have proven to be efficient commercial farmers, when given a chance" (Byerlee and De Janvry, 2009). Family farmers in Africa and Asia meet 80% of the food needs on these continents (EAFF et al., 2013) and in the future, they will produce more, efficiently and sustainably, provided that public policies support them (McKeon and Cissokho, 2013). Two economic arguments buttress this contention. First, the "inverse relationship", a stylized fact which indicates that in many situations in labor-abundant developing countries, the smaller the farm size, the higher will be the land's productivity (Berry and Cline, 1979; Binswanger et al., 1995; Lipton, 2009). Second, economies of scale are not guaranteed in agricultural activities as machinery costs and personal shifting costs increase rapidly with the farm area, as well as the costs of staff coaching and surveillance, so much so as to quickly offset the economies of scale (Boussard, 1987; Mazoyer and Roudart, 2006).

Another question is to what extent smallholders will produce rice beyond what they need for their own consumption and for exchange against the basic goods and services they do not produce themselves. In Chayanov's words, will the balance between the marginal utility of income and the marginal disutility of labor lead them to produce little beyond these needs? Again, the experience of the Green Revolution in Asia supports the idea of high production levels, close to the maximum possible (Lipton, 2005; Byerlee and De Janvry, 2009). In addition, local food markets sup-

plied by smallholders are very active in Africa, even though they are barely visible because they are informal (EAFF et al., 2013). And our survey in the ON shows that the small fraction of smallholders who presently have access to relatively large areas cultivate as much rice as possible, and vegetables also, obviously within the limits delineated by their constraints. This is explained by their desire to buy other goods and services beyond what is strictly necessary, which increases the marginal utility of their income (Ellis, 1994). Another explanation is that these cropping activities generate incomes per day of work which are higher than the incomes generated by the non-farm activities available today (Losch et al., 2012).

The scenarios presented above are focused on rice production. However, as mentioned above, rice cropping in the ON is often inserted within farming systems that also include various vegetable cropping activities (shallot, tomato, okra, sweet potato) and animal husbandry. Better management of irrigation water in the dry season, as well as access to credit and inputs, would help expand vegetable crops, and the increase in farm incomes would favor livestock development, thus leading to diet diversification for both the farm and non-farm populations, through domestic consumption and sale.

The strategy considered in this article is consistent with the first of the *Principles for Responsible Investment in Agriculture and Food Systems*, which states that investment should "contribute to food security and nutrition" by "improving income and reducing poverty (. . . and) improving the ability to produce food for oneself and others" (CFS, 2014).

5. Conclusion

Our results indicate that family farmers in the ON could invest in land within the context of proactive policies: a land policy allocating large enough plots of new irrigated land to these farmers; an irrigation policy ensuring infrastructure extension and maintenance as well as effective water management; a credit policy enabling farmers to have access to animal-drawn or motorized equipment, as well as mineral fertilizers; an input policy regarding the quality, and possibly the availability, of these. Such policy measures could lead to the creation of tens of thousands of farm jobs and/or to the production of additional hundreds of thousands of tonnes of rice, to the point of exceeding grain self-sufficiency. Yet, given the demographic growth and macroeconomic structures in Mali, the challenges of farm job creation and staple food production are crucial. Thus, the opportunity costs of allocating land and irrigation water to investors other than faming families are particularly high.

These policy measures could be part of a wider "National Smallholder Investment Strategy" as called for by the High Level Panel of Experts of the Committee on World Food Security (2013). Such a strategy would include other policy measures regarding the production side of family farms, notably measures aiming to ensure sufficiently high and stable farm incomes. But it would also include complementary public investments in services such as education and health, that could also help release funds from farming family budgets with a view to investment. More broadly, even if the ON is very important in terms of cereal production, a "National Smallholder Investment Strategy" cannot be limited to this region only: it should take into account all the agricultural regions of the country, all of which produce cereals, particularly those with rainfed cereal-cropping.

Acknowledgements

This study was funded by OXFAM, SOSFaim Belgium and Luxembourg, the Canadian International Development Agency and the World Bank. We wish to thank the two anonymous reviewers for their very relevant comments on an earlier draft of this paper. The remaining shortcomings are our sole responsibility.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.landusepol.2016.10.029.

References

Adamczewski, A., Jamin, J.-Y., Tonneau, J.-P., 2011. Investisseurs versus paysans locaux: vers quelle agriculture irriguée au Mali? L'exemple du secteur sucrier. Transcontinentales 10/11.
Adamczewski-Hertzog, A., Hertzog, T., Jamin, J.-Y., Tonneau, J.-P., 2015. Competition for irrigated land: inequitable land management in the Office du Niger (Mali). Int. J. Sustain. Dev. 18, 161–179.
Ancey, G., 1975. Niveaux de décision et fonctions objectif en milieu rural africain (No 3). AMIRA, Paris.
Anseeuw, W., Alden Wily, L., Cotula, L., Taylor, M., 2012. Land Rights and the Rush for Land: Findings of the Global Commercial Pressures on Land Research Project. ILC, Rome.
Assemblée nationale de la République du Mali, 2006. Loi N° 06-40/AN-RM portant loi d'orientation agricole. Bamako (Mali).
Bélières, J.F., Coulibaly, Y., Keita, A., Sanogo, M.K., 2003. Caractérisation des exploitations agricoles de la zone de l'Office du Niger en 2000. Office du Niger, DADR-URDOC, Nyeta Conseils, Ségou, Mali.
Bélières, J.-F., Hilhorst, T., Kébé, D., Keïta, M.S., Keïta, S., Sanogo, O., 2011. Irrigation et pauvreté: le cas de l'Office du Niger au Mali. Cahiers Agricultures 20, 144–149.
Bélières, J.-F., Bonnal, P., Bosc, P.-M., Losch, B., Marzin, J., Sourisseau, J.-M., 2014. Les agricultures familiales du monde: définitions, contributions et politiques publiques. Agence française de développement, Paris.
Banque africaine de développement, 2012. Le capital-investissement en Afrique à l'appui de la croissance inclusive et durable.
Bernstein, H., 2009. Agrarian questions from transition to globalization. In: Akram-Lodhi, A.H., Kay, C. (Eds.), Peasants and Globalization: Political Economy, Rural Transformation and the Agrarian Question. , pp. 239–261.
Berry, R.A., Cline, W.R., (Eds.), 1979. Agrarian Structure and Productivity in Developing Countries, Johns Hopkins University Press; Baltimore.
Bezu, S., Barrett, C.B., 2010. Activity choice in rural non-farm employment (RNFE): Survival versus accumulative strategy. Munich Personal RePEc Archive, Paper N° 55034.
Binswanger, H.P., Deininger, K., Feder, G., 1995. Power, distortions, revolt and reform in agricultural land relations. In: Behrman, J., Srinivasan, T.N. (Eds.), Handbook of Development Economics. North Holland, Amsterdam, pp. 2693–2707.
Boussard, J.-M., 1987. Economie de l'agriculture. Economica, Paris.
Bricas, N., Daviron, B., 2009. De la hausse des prix au retour du «productionnisme» agricole: les enjeux du sommet sur la sécurité alimentaire de juin 2008 à Rome. Hérodote 131, 31–39.
Burnod, P., Papazian, H., Adamczewski, A., Bosc, P.-M., Tonneau, J.-P., Jamin, J.-Y., 2011. Regulation of large-Scale agricultural investments: case studies of Madagascar and Mali. Afrique contemporaine 237, 111–129.
Byerlee, D., De Janvry, A., 2009. Smallholders unite Letter to the editor. Foreign Affairs 88.
Byerlee, D., De Janvry, A., Sadoulet, E., 2009. Agriculture for development: toward a new paradigm. Annu. Rev. Resour. Econ. 1, 15–31.
Committee on World Food Security, 2014. Principles for Responsible Investment in Agriculture and Food Systems.
Chambers, R., Conway, G., 1991. Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. Institute of Development Studies, Brighton (UK).
Chang, H.-J., 2012. Rethinking public policy in agriculture: lessons from history, distant and recent. In: Public Policy and Agricultural Development. Routledge, pp. 3–68.
Chayanov, A., 1986. The Theory of Peasant Economy. The University of Wisconsin Press, Madison.
Cissé, Y., Bonin, M., Nesheim, I., Tonneau, J.-P., Verburg, R., 2012. Land degradation and irrigation practices in the Office du Niger, Mali. In: McNeil, D., Nesheim, I., Brouwer, F. (Eds.), Land Use Policies for Sustainable Development: Exploring Integrated Assessment Approaches. Edward Elgar Publishing, Cheltenham (UK) and Northampton (US).
Colin, J.-P., Crawford, E.W. (Eds.), 2000. Research on Agricultural Systems: Accomplishments, Perspectives and Issues. Nova Science Publishers, Inc, New York.
Collier, P., 2008. Politics of hunger – how illusion and greed fan the food crisis. Foreign Affairs 87.
Couture, J.-L., Lavigne Delville, P., Spinat, J.-B., Cluster, E.D.R., 2002. Institutional Innovations and Water Management in Office du Niger (1910–1999). The Long Failure and New Success of a Big Irrigation Scheme. GRET, Paris.

Crédit suisse, CDC, EMPEA, IFC, WWF, 2015. Private equity and emerging markets agribusiness. Build. Value Through Sustain.
Darnhofer, I., Gibbon, D.P., Dedieu, B., 2012. Farming Systems Research into the 21 St Century: The New Dynamic. Springer, Dordrecht.
Dave, B., Mazoyer, M., Roudart, L., 2012. Paysans investisseurs. La faisabilité économique de la proposition du SEXAGON. SEXAGON, Bamako (Mali).
Dave, B., 2007. Office du Niger au Mali: les chiffres officiels de la production rizicole sont surestimés. Les Cahiers de Mande Bukari 6, 19–43.
Davis, B., Winters, P., Carletto, G., Covarrubias, K., Quiñones, E.J., Zezza, A., Stamoulis, K., Azzarri, C., DiGiuseppe, S., 2010. A cross-country comparison of rural income generating activities. World Dev. 38, 48–63.
De Schutter, O., 2011. How not to think of land-grabbing: three critiques of large-scale investments in farmland. J. Peasant Stud. 38, 249–279.
Deininger, K.W., Byerlee, D., 2010. Rising Global Interest in Farmland: Can It Yield Sustainable and Equitable Benefits? World Bank, Washington.
Du Castel, A., 2016. Cultiver le capital. Une analyse de la financiarisation de l'agriculture en Afrique du sud par les filières agro-financières du private equity (PhD). University of Paris Saclay.
EAFF ROPPA, PROPAC, 2013. Les agriculteurs familiaux luttent pour des systèmes alimentaires durables. Synthèse des rapports des réseaux régionaux africains sur les modèles de production, la consommation et les marchés.
Ellis, F., 1994. Peasant Economics: Farm Households in Agrarian Development. Cambridge University Press, Cambridge.
Ellis, F., 2000. Rural Livelihoods and Diversity in Developing Countries. Oxford University Press, Oxford.
FAO, 2010. Agricultural Investment Funds for Developing Countries.
FAO, 2012. The State of Food and Agriculture. Investing in Agriculture for a Better Future.
FAO, 2016. http://faostat3.fao.org/.
Gafsi, M., Dugué, P., Jamin, J.-Y., Brossier, J., (Eds.), 2007. Exploitations agricoles familiales en Afrique de l'Ouest et du Centre: enjeux, caractéristiques et éléments de gestion, Quae; Versailles.
Garner, E., de la O Campos, A.P., n.d. Identifying the Family Farm: An Informal Discussion of the Concepts and Definitions. FAO, ESA Working Paper 14, Rome.
Gironde, C., Golay, C., Messerli, P., 2015. Large-Scale Land Acquisitions, Livelihoods and Human Rights in South-East Asia International Development Policy. The Graduate Institute Geneva/Brill Nijhoff, Geneva, Leiden.
Griffon, M., 2006. Nourrir la planète: pour une révolution doublement verte. Odile Jacob, Paris.
HLPE, 2013. Investing in Smallholder Agriculture for Food Security. A Report by the High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security. HLPE, Rome.
Haggblade, S., Hazell, P., Reardon, T., 2010. The rural non-farm economy: prospects for growth and poverty reduction. World Dev. 38, 1429–1441.
Hathie, I., Wade, I., Ba, S., Niang, A., Niang, M., Sow, M.K., Ndione, Y.C., Ba, C.O., 2015. Emploi des jeunes et migration en Afrique de l'Ouest Rapport final Sénégal. CRDI, AFD, Ottawa, Paris.
HazellP, B.R, Ramasamy, C., (Eds.), 1991. The Green Revolution Reconsidered: The Impact of High-Yielding Rice Varieties in South India, The Johns Hopkins University Press Baltimore, London.
Hertzog, T., Adamczewski, A., Molle, F., Poussin, J.-C., Jamin, J.-Y., 2012. Ostrich-like strategies in Sahelian sands? Land and water grabbing in the Office du Niger, Mali. Water Altern. 5, 304–321.
Kanbur, R., (Ed), 2003. Q-squared, Combining Qualitative and Quantitative Methods in Poverty Appraisal, Permanent black; New Delhi.
Keita, A., 2012. Paysans investisseurs. La faisabilité juridique de la proposition du SEXAGON. SEXAGON, Bamako (Mali).
Krueger, A.O., Schiff, M., Valdes, A., (Eds.), 1991. The Political Economy of Agricultural Pricing Policy, World Bank; Washington.
Kuper, M., Tonneau, J.-P., Bonneval, P., (Eds.), 2002. L'Office du Niger, grenier à riz du Mali: succès économiques, transitions culturelles et politiques de développement, Karthala; Paris.
Lamarche, H., 1991. L'agriculture Familiale: Une réalité polymorphe. L'Harmattan, Paris.
Land Matrix, 2016. Newsletter, Various issues.
Li, T.M., 2011. Centering labor in the land grab debate. The Journal of Peasant Studies 38, 281–298.
Lipton, M., 2005. The Family Farm in a Globalizing World: The Role of Crop Science in Alleviating Poverty. IFPRI.
Lipton, M., 2009. Land Reform in Developing Countries: Property Rights and Property Wrongs. Routledge, London, New York.
Losch, B., Fréguin-Gresh, S., White, E.T., 2012. Structural Transformation and Rural Change Revisited: Challenges for Late Developing Countries in a Globalizing World. World Bank, Washington.
Losch B., 2012. Le défi de l'emploi, le rôle de l'agriculture et les impasses du débat international sur le développement. Presented at the Symposium Évolution du marché international du travail, impacts des exclusions paysannes, Conseil économique, social et environnemental, Paris.
Lowder, S., Carisma, B., Skoet, J., 2012. Who Invests in Agriculture and How Much? An Empirical Review of the Relative Size of Various Investments in Agriculture in Low-and Middle-income Countries. FAO, ESA Working Paper, Rome.
Marsland N., Wilson I., Abeyasekera S., Kleih U., 2000. A methodological framework for combining quantitative and qualitative survey methods. DFID Project R7033: Methodological Framework Integrating Qualitative and Quantitative Approaches for Socio-Economic Survey Work.
Mazoyer, M., Roudart, L., 2006. A History of World Agriculture: from the Neolithic Age to the Current Crisis. Earthscan Publications, London.
Mazoyer, M., 1963. Les modalités d'application de la recherche opérationnelle en agriculture. Revue française de recherche opérationnelle 27, 107–129.
McKeon, N., Cissokho, M., 2013. Investing in Smallholders and Food Security in Africa: What Do Small-Scale Producers Themselves Have to Say? FAO, Rome.
McMichael, P., 2013. Food Regimes and Agrarian Questions, Agrarian Change and Peasant Studies. Fernwood Publishing, Halifax and Winnipeg.
Mellor, J.W., 1998. Foreign aid and agriculture-led development. In: Eicher, C.K., Staatz, J.M. (Eds.), International Agricultural Development. The Johns Hopkins University Press, Baltimore London, pp. 55–66.
Mendras, H., 1976. Sociétés paysannes: éléments pour une théorie de la paysannerie. Armand Colin, Paris.
Nesheim, I., Reidsma, P., Bezlepkina, I., et al., 2014. Causal chains, policy trade offs and sustainability: analysing land (mis)use in seven countries in the South. Land Use Policy 37, 60–70.
Institute, Oakland, 2011. Comprendre les investissements fonciers en Afrique Rapport: Mali. Oakland Institute, Oakland (US).
PROPAC ROPPA, EAFF, 2011. Les investissements dans l'agriculture pour renforcer l'agriculture familiale et les systèmes alimentaires durables en Afrique.
République du Mali, 2012. Orientations et priorités du gouvernement pour la période 2013–18.
République du Mali, 2013a. Plan pour la Relance Durable du Mali 2013–2014.
République du Mali, 2013b. Politique de Développement Agricole du Mali.
Roudart, L., 2001. Morcellement et modernité de l'agriculture égyptienne. In: Jouve, A.-M. (Ed.), Le Morcellement Des Terres En Méditerranée. Karthala, Paris.
Roudart, L., 2008. Politiques agricoles et négociations internationales. In: Encyclopaedia. Universalis Universalis, Paris.
SEXAGON (Syndicat des exploitants agricoles de l'Office du Niger), 2010. Paysans investisseurs à l'Office du Niger. SEXAGON, Niono (Mali).
Samaké, A., Bélières, J.F., Corniaux, C., Dembelé, N., Kelly, V., Marzin, J., Sanogo, O., Staatz, J., 2008. Changements structurels des économies rurales dans la mondialisation Programme Ruralstruc, phase II. IER, MSU, CIRAD, Bamako, East Lansing (USA), Montpellier.
Sangaré, A., 2010. Etude relative à l'établissement d'un bilan des ressources en eau dans la zone Office du Niger. Rapport final. Banque Africaine de Développement, Abidjan.
Schüttrumpf, R., Bökkers, T., 2008. Analyse du potentiel d'irrigation lors de la saison sèche dans la zone Office du Niger. Office du Niger, Ségou (Mali).
Scheidel, A., Giampietro, M., Ramos-Martin, J., 2013. Self-sufficiency or surplus: conflicting local and national rural development goals in Cambodia. Land Use Policy 34, 342–352.
Shanin, T., 1973. The nature and logic of the peasant economy 1: A Generalisation. J. Peasant Stud. 1, 63–80.
Silici, L., Locke, A., 2013. Private Equity Investments and Agricultural Development in Africa: Opportunities and Challenges. Future Agricultures, Working Paper 62.
Sourisseau, J.-M., Soumaré, M., Bélières, J.-F., Guengant, J.-P., Bourgeois, R., Coulibaly, B., Traoré, S., 2016. Diagnostic territorial de la région de Ségou au Mali. Agence française de développement, Paris.
Sourisseau, J.-M., 2014. Agricultures familiales et mondes à venir. Quae, Versailles.
Timmer, C.P., 2009. A world without Agriculture. The structural transformation in historical perspective. The AEI Press, Washington.
Trébuil, G., Hossain, M., 2004. Le riz: Enjeux écologiques et économiques. Belin, Paris.
Traoré, I., 2008. Disponibilité de l'eau à l'Office du Niger. Office du Niger, Ségou (Mali).
United Nations/Department of Economic and Social Affairs/Population Division, 2011. World Population Prospects. The 2010 Revision.
United Nations/Department of Economic and Social Affairs/Population Division, 2015. World Population Prospects. The 2015 Revision.
Van der Ploeg, J.D., 2013. Peasants and the Art of Farming: A Chayanovian Manifesto. Fernwood Publishing, Halifax and Winnipeg.
Weis, T., 2007. The Global Food Economy: the Battle for the Future of Farming. Zed Books, London, New York.
White, B., Borras Jr, S.M., Hall, R., Scoones, I., Wolford, W., 2012. The new enclosures: critical perspectives on corporate land deals. J. Peasant Stud. 39, 619–647.
World Bank, 2007. Agriculture for Development, World Development Report 2008. World Bank, Washington.