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Large private agricultural projects and job creation: From discourse to reality. Case study in Sella Limba, Sierra Leone

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ABSTRACT

Large private agricultural projects are described by their promoters as “win-win” partnerships: investments supposedly make it possible to increase agricultural productivity in developing countries, and to create thousands of jobs in the industry. These arguments, which are used in Sierra Leone where the priority of the agricultural policy is to attract foreign capitals, rely on the conviction that lands occupied by large private agricultural projects are “under-farmed” or even “unused” and that, therefore, their opportunity cost is nil. However, where family farms are well-established, the differential between the jobs created and those destroyed must be examined carefully. This is what we propose to do in this article, by examining the case of an ethanol and electricity production unit relying on an industrial sugar cane plantation of more than 12 500 ha, in the centre of the country. By analysing family farming in a control region close to that of the project, we show that family farming supplanted by the project would enable more farm labourers to make a living than the number of jobs potentially created by the industrial production unit.

1. Introduction

Large-scale agricultural land grabbing by public or private actors has been increasing since the 2007–2008 surge in agricultural prices on unprecedented proportions (Technical Committee on Land Tenure and Development, 2010). Since 2000, transnational deals have been concluded for nearly fifty million hectares according to the Land Matrix database.[1] This movement concerns mainly developing countries where private investors look for opportunities to make significant profits while diversifying their portfolios. Land grabbing has raised a various range of interconnected issues: local, national and global governance; social rural class differentiation, agrarian structure, etc. (Borras and al. 2011). At a broader level, it reactivates the classic agrarian question of labour and capital (Oya, 2013). Given that the historical European path of a massive transfer of labour from agriculture to industry and services is not likely to be replicated simply in the contemporary developing African countries (Losch and Fréguin-Gresh, 2013), are large-scale agro-industrial corporations likely to tackle the challenge of an inclusive agricultural growth, especially regarding to rural youth employment?

Three arguments are presented in support of these investments: (1) Global agricultural (and energy) production needs to rise to face the ever-growing needs of humanity(CAS, 2010; World Bank, 2007). (2) Almost one billion hectares of good quality land is “available”, especially in Africa and Latin America (Fischer et al., 2002). (3) In these regions, neither states nor farmers have the capacity to invest and access modern technologies (CAS, 2010; FAO, 2009; UNCTAD, 2009), and global investors alone are able to bring the capital required for addressing these challenges (Deininger and Byerlee, 2011). In light of such considerations, in the last two decades, international institutions have prompted targeted countries to adapt their national legislations to favour massive entry of foreign capital into the agricultural sector. “Win-win” narratives have been developed, and the promise of high levels of job creation and income generation is supposed to make these investments acceptable for local populations. In this article, through the study of an emblematic agro-industrial project in Sierra Leone, we examine the impact of large-scale corporate agricultural projects on job creation or reduction in developing countries.

In Sierra Leone, the president elected in 2007 made a priority of attracting foreign capital in the agricultural sector. In 2008, the Sierra Leone Investment and Export Promotion Agency (SLIEPA) was created, a special agency independent from the Ministry of Agriculture, Forestry

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[1] See www.landmatrix.org, accessed on 23 January 2018.

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and Food Security (MAFFS). The promotional campaign of the SLIEPA applies the global arguments presented above to the Sierra Leonean case. So-called traditional agriculture deemed unable to answer the productivity challenge leaves 89% of the arable land "uncultivated".[2] More specifically addressed to potential investors, the arguments of the SLIPEA aimed to highlight the comparative advantages of this small country, among the poorest in the world, in relation to other producers of tropical agricultural products. First, land is cheap in Sierra Leone: approximately 12 USD per hectare and per year, much less than in Brazil or Indonesia. Then, labour cost is lower than in South Africa or India and the SLIEPA promised investors a "flexible labour law". Finally, the Government guarantee "very attractive rates" and five years tax holidays on company profits. These provisions constitute a minimum, insofar as the government is prepared to negotiate better conditions on a case-by-case basis (Baxter, 2013). This promotional campaign seemed to bear fruit: although it arrived late in the international competition to attract foreign direct investment because of a long civil war between 1994 and 2001, Sierra Leone made up for lost time. The Land Matrix database shows that more than 24 international private agricultural projects are under negotiation or approved in Sierra Leone and that land under contract is above 750 000 ha. As such, Sierra Leone is second on the continent for surface area under contract in relation to its agricultural surface area (after Liberia) and fourth in relation to its population (after Gabon, Congo and Liberia).

In the centre of Sierra Leone, an electricity and ethanol production unit originally operated by Addax BioEnergy, a subsidiary of Swiss group AOG, is a flagship project for the Government. It includes a large-scale sugarcane estate and an ethanol processing factory. The project covers 15 500 ha, of which 12 500 ha are for sugar cane, 1 000 ha for the plant and various infrastructures, and 2 000 ha for buffer zones (CES, 2009). However, we will see that the surface area impacted by the project exceeds the surface area actually mobilised. According to Chouquer (2013), a 50-year lease was signed for a 57 000-ha concession in order to prepare a potential second phase with double the surface area planted with sugar cane. The planned rental comes to 12.5 $ per hectare per year, of which half is paid to the identified land owners[3] and half to the regional and national administrations. The project is to lead to the production of 85 000 m^3 of ethanol intended for the European market and 15 MW sold on the national electricity grid.

The impact study specified that at full capacity 2 200 permanent workers and 2 500 seasonal workers would be recruited in Sierra Leone for the plantation and the plant (CES, 2009). The Memorandum of Understanding signed with the government anticipated the creation of 3 000 jobs for the first phase and 1 000 more for the second phase of the project. The Government put these figures forward when promoting the project.

Foreign investments in large agricultural projects in Sierra Leone and the Addax BioEnergy project in particular have been the subject of several academic works. Authors have examined local governance issues created by the establishment of contracts between national administration-backed multinationals and local populations (Millar, 2015a; Yengoh et al., 2016). They have noted the difficulties local populations have in negotiating the best "deals". The women appear especially vulnerable and are seen as actors with a lot to lose in these agreements (Millar, 2015b; Yengoh et al., 2015). Maconachie and Fortin (2013) have questioned the "sustainability" of these investments, in relation to the type and number of jobs created in particular. Finally, the literature is critical to varying extents of the government's policy defined as "liberal". It has questioned the conditions under which these large agro-industrial projects operate, but not the economic bases on which this policy relies, in relation to job creation for rural youth in particular.

A brief review of large private agricultural projects in developing countries suggests that where they lead to substitute family farming by corporate farming assertions about jobs creation must be taken with caution. A method for rigorously assessing the net creation of jobs through this type of investment is then proposed. A counterfactual scenario is established to estimate the number of people who should have been able to work in peasant agriculture by cultivating the same ecosystems. For this purpose, in the third section, a detailed study of the local agriculture in a region close to the area of the Addax BioEnergy project puts forward the complexity of the family farming system. This analyse finally lead to estimate the differential between created and destroyed jobs in the fourth and last section.

2. Land grabbing and agricultural investments: job creation or eviction?

According to most governmental and multinational agencies, the beneficial injection of capital in the agriculture of developing countries is a powerful leverage for the creation of direct jobs in agriculture and for income generation (salaries, rents paid to eligible parties), both underlying a "win-win" partnership (CAS, 2010; Cotula et al., 2010; Deininger and Byerlee, 2011; FAO, 2009; Von Braun and Meinzen-Dick, 2009). Others denounce the destructive potential of this type of investment, particularly through the processes of eviction and the consequent massive job loss (for example: "Land and Development" Technical Committee on Land Tenure and Development, 2010; De Schutter, 2009; Li, 2011). Diverse situations must be considered.

2.1. Job creation

In frontier situations, land takeovers and agricultural development occur to the detriment of large forested lands with very small populations, as for example in Indonesia with oil palm plantations, in the Amazonian Basin with extensive cattle breeding development or in the Brazilian *cerrado* with soya cultivation. In these situations, the nature of the established production systems determines their capacity to create jobs: low in the case of extensive cattle breeding or mechanised agriculture; significantly greater for certain perennial plantations where many tasks remain manual (harvesting palm clusters or tapping rubber trees, for example). In Indonesia, for example, oil palm plantations development is said to have led to the creation of a job for every 2 ha of land, i.e. 1,7 milluon job (Deininger, 2011).

Other "net job creator" projects are found with certain large-scale irrigation development projects. When the authorities no longer finance such infrastructures, they call on private investors that benefit from large land concessions under advantageous conditions. When these new infrastructures lead to the cultivation of formerly desert areas, like on the Peruvian coast for example, and their water usage does not penalise anyone upstream or downstream, then there is indeed net job creation. A last scenario is that of agro-industrial investments strengthening the processing industry and the marketing of agricultural production intended for exportation or domestic market. Investments may be profitable for small and medium family farms by offering them a more secure outlet for their production. The case of certain oases on the Peruvian coast, where fruit and vegetables are produced for export (artichoke and asparagus, among others), illustrates this situation (Marshall et al., 2012). It is in this type of situation that so-called "contract farming" is presented as being a priori compatible with the maintenance and development of modest-size family farms whose income can be increased and secured. Finally, many industrial processing units partly supplied by local farmers could be mention in Sub-Saharan Africa: cotton, palm oil, rubber and so on. The effects of this type of project on employment and income must also be analysed on case-by-case basis (Delarue and Cochet, 2013).

[2] See the SLIEPA website: www.investsierraleone.biz and the presentation "Sierra Leone: Africa's New Investment Destination" in particular, accessed on 7 May 2016.

[3] How the "identified land owners" have been identified is not specified in the project description.

2.2. Where land grabbing and large-scale projects inevitably cause net job destruction

Except the situations mentioned above which may create jobs and income, most land targeted by national or international private capital holders is already used by local populations (Messerli et al., 2014). The land is nonetheless defined by investors and governments alike as "under-utilised" or even "free" or "unused", i.e., unexploited and for which the opportunity cost of land, water resources and labour force is low. According to this premise, capital input and agricultural modernisation lead to the expansion of agricultural land, intensification and then significant job creation and income generation.

However, caution is advised concerning these hasty assertions. An in-depth examination of several cases of ongoing or planned investment projects in Sub-Saharan Africa suggests opposite results (Cochet, 2014). There is substitution of one type of farming by another, and the balance between job creation and loss must be examined in detail. Indeed, many investment projects target spaces that have been occupied for a long time by farming societies often characterised by relatively high population density and labour intensive production systems. This is the case in certain great African deltas, for example, where pastoral, agricultural or fishing activities are concentrated: internal deltas from Niger to Mali (Brondeau, 2013), the Awash in Ethiopia (Boulard, 2011), the deltas of Rufiji and Tana in East Africa (Duvail et al., 2010; Mwansasu and Westerberg, 2014) and the delta of Chari on the border between Cameroon and Chad. In the last case, the flood-recession lands, which are exploited by local populations for food crops and halieutic activities and by the surrounding cattle breeders for grazing, have been promised to large maize cultivation projects. The expected cereal production and the promise of job creation do not compensate the production loss resulting from abandoning the current production system farming practices (Rangé, 2016).

The untimely cultivation of areas previously used for grazing, sometimes seasonally, when exclusively allocated to investors as in Ethiopia, can also lead to serious disruptions for the farming economy of the neighbouring populations. Common pastures enable resident families to maintain a small herd and fertilise crop fields without resorting to unaffordable artificial fertilisers. Their allocation to corporations and changes in their use and access can provoke an irreversible fertility crisis and subject hundreds or thousands of families to food shortage (Cochet, 2014).

Generally, the objective of investors, whoever they are, is not to create jobs (Li, 2011). They can certainly make promises in this regard when compelled by the host country and the acceptability of the project for local populations depends on it. However, in addition to fertile and flat lands, irrigation water, transport infrastructures and advantageous taxation (*supra*), investors seek to minimise labour costs and, therefore, the wage bill. The way that value-added is shared always favours the remuneration of capital to the detriment of labour remuneration (Cochet, 2017).

These projects most often consist in establishing large and often specialised production units with powerful equipment (but also calling on an abundant manual labour force in some farming systems or cropping operations), instead of more diversified smaller family farms that have less powerful equipment. The land grabbing reactivates the old debate on the comparative efficiency of the different types of agriculture (family farming versus corporate farming).

Here, assertions about job creation induced by corporate farming projects in developing countries are taken critically. They also result into job destruction. A region of nearby location and similar ecology is taken as a counterfactual scenario to determine the "employment" in existing local peasant farming and finally the actual job creation (or destruction) induced by the Addax project in Sierra Leone. In the next part, this approach is detailed.

3. Materials and methods

Most policy makers deem peasant production systems in developing countries to be notoriously incapable of producing efficiently and *a fortiori* of creating jobs in sufficient numbers. Jobs created within the framework of large corporate farming projects are perceived as an advantage for the community. However, most projects traget areas benefitting from conditions that are eminently in favour of agriculture (soil fertility, water resources) and therefore have generally been exploited for a long time.

Large-scale investments implemented by public or private foreign agents substitute pre-existing agrarian systems with new ones. Job creation may be uncertain. There is a risk that a large proportion of the created jobs result from existing jobs being substituted. The net job creation may be then much lower, or even negative, than claimed by investors or state departments in charge to facilitate investments.

3.1. Need to compare the project scenario to a counterfactual scenario

We propose to measure the differential of jobs obtained through the establishment of the project, i.e., to compare the number of jobs created by the project to the number of jobs in the farming system replaced by the project. We use methods long used in most project evaluations (Baker, 2000; Bridier et al., 1980; Dufumier, 1996; Gittinger, 1985). They rely on a simple principle, measuring a differential between two situations: one that results from the project's establishment and the other that would have prevailed if the project had not been established (counterfactual scenario, i.e. "without project").

In the absence of a sufficiently accurate and rigorous preliminary survey in the actual project area, the establishment of a counterfactual scenario requires taking precautions to avoid creating biases that would distort the comparison. To this end, we need to identify a "control area", i.e., a region as similar as possible to that directly concerned by the project regarding to the environmental conditions and the socio-economic conditions, origin of settlement and population density, cultivation and breeding techniques, market access, etc.

Once the control area has been identified, we can carry out a diagnosis to take inventory of the situation at the beginning (before the project) with regards to resource use (land, water and labour force) and by identifying alternative uses of these production factors were the investment project not realised. This diagnosis lead to measuring the real opportunity cost of local resources dedicated to the project (e.g., opportunity costs of land, labour force and water in case the project includes an irrigation phase).

3.2. Identification of the "control" area chosen for establishing a counterfactual scenario

To identify a control area, we can start from the main characteristics of the cultivated environment. Main physical regions of Sierra Leone consist in northwest/southeast strips parallel to the coast. Following Gwynne-Jones (1978), we can distinguish an "internal plateau" with steep reliefs reaching 500 m above sea level on average and an "internal plain" with less steep reliefs. At the foot of the escarpment separating the plateau from the plain, there is a flat region characterised by large seasonally flooded basins, known in the scientific literature and in Kryo, the Sierra Leonean Creole English, as the Bolilands (see Map 1).

The area of the sugar cane plantation and ethanol production unit project is situated south of that specific region, in the Rokel Basin in the chiefdom of Makari Gbanti. The control zone, also situated in the Bolilands, is situated 80 km north,in the Little Scarcies Basin and in the chiefdom of Sella Limba (Fig. 1).

In both areas, farming is strictly manual, without use of industrial input or power tools. Rice-growing has prevailed in these regions for a long time (FAO, 1979). On the whole, the Bolilands stayed out of the national development of cocoa plantations, Sierra Leone's main

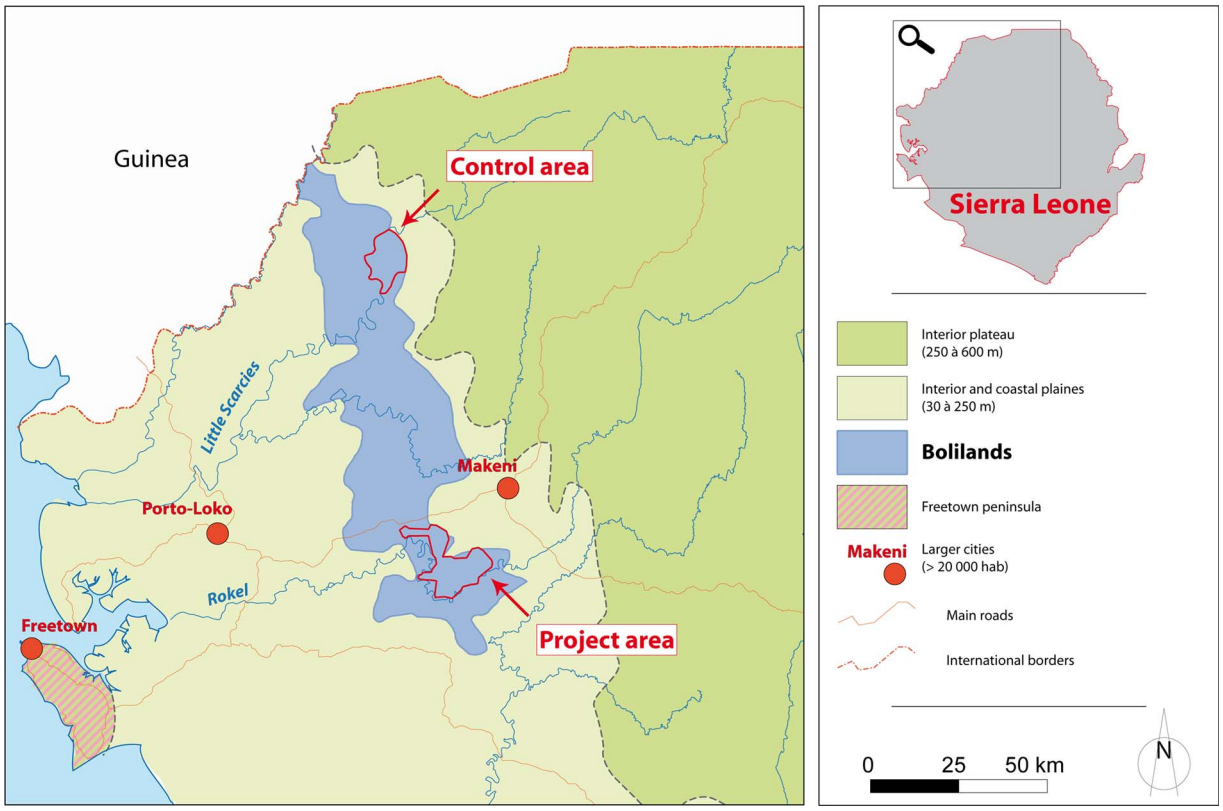

Fig. 1. Map of the location of the Bolilands, the zone of the project and the control zone in the northwest of Sierra Leone. Sources: Clarke (1969); Gwynne-Jones (1978); and Openstreetmap.org.
(source: authors)

agricultural export product, and diamond mining, the country's main mineral resource. Finally, the project area and the control area have similar population density. A census carried out in 2011 determined that the population density of the control area, which covers an area of 110 km^2 and includes 24 villages, was 44 inhabitants per km^2. The impact study commissioned by Addax BioEnergy within the framework of the project's preparation, based on the same counting method, indicates that "*17 285 live within the 33,500 ha SIA* [Social Impact Assessment] *study area*" (CES, 2009). Population density in the project area is therefore approximately 52 inhabitants per km^2. As such, the population density of the two areas is comparable. However, at the level of the two chiefdoms concerned (that of Sella Limba and that of Makari Gbanti), population densities are generally higher and can locally exceed 150 inhabitants per km^2 in rural areas. The project area and the control area are therefore both relatively little populated compared with the regional average. This situation results from the recent settlement of populations in the Bolilands (*infra*).

However, the socioeconomic conditions from one area to another, even in neighbouring regions, cannot be entirely equivalent. In this regard, as the project area is closer to the tar road linking Makeni to Freetown, it probably benefitted from better access to regional or national urban markets than those from the control area, which is situated further north. In fact, this may be why promoters chose to locate the project there.

This difference being taken into account, we propose to use the surveys conducted in the control zone to establish a counterfactual scenario to that "with project".

3.3. Technical and economic analysis of farming practices: a system approach

The establishment of a counterfactual scenario requires an approach that can grasp that diversity and complexity of the local economy of farming practices. In large corporate farms, mechanisation and the use of industrial inputs require the simplification of the environment like development of large range of flat and homogenous fields. By contrast, smallholders compensate the weakness of their equipment by taking advantage of all the diversity of agro-ecosystems they can access.

Farming practices will be considered as part of an *agrarian system*. This concept at the core of our approach encompasses "*the mode of exploitation of a given environment* […]*; the social relations of production and trade that have led to its implementation and development*[…] *as well as the conditions affecting the distribution of resulting value added;* [and] *finally the characteristics of the specialisation and social division of labour, within each sector, and the economic, social and political conditions—particularly relative pricing systems—that influence the farmers' integration in global markets*" (Cochet, 2012). Although used by French geographers as early as the middle of the 1900s, it has been taken over and redefined by French agronomists and agro-economists from the 1970s onwards (Cochet, 2012). As such, the agrarian system cannot be considered as a technical system of agricultural practices nor as farmland distribution structures only, but should include the technical transformations and modifications that intervene in the social relations, not only at the local but also at the national or international levels.

At the regional level, several cropping systems will be defined, each corresponding to a specific landscape facet, i.e., spatial units defined by the ecological environment and its exploitation by farmers (Blanc-Pamard, 1990). The cropping system is defined by a succession and/or an association of crops, and all the techniques are applied following a specific order. The agronomic logic of the cropping system is then closely linked to pedo-climatic and socio-economic conditions (resource access conditions). What occurs at the field level, what grows there, the conditions under which this occurs, the way one sets about it and the field's history, all this "makes" the system.

The domestic unit constitutes the basic unit of the "rural fabric": it is the basic level of organisation of the agricultural production process — the farming system — where social and economic logics fit into one another, where solidarities, contradictions and conflicts build up, and where differentiation mechanisms occur. The concept of the farming system makes it possible to analyse how domestic units are structured and function. However, rather than used on a case-by-case basis for a given farm unit, the concept makes it possible to study a set of farm units with the same range of resources, as long as they evolved in comparable socioeconomic conditions and combine similar, vegetal and/or animal, productions. As such, the concept of farming system makes it possible to describe a group of domestic units which, without being identical, present common features (Cochet and Devienne, 2006), leading to a representation "modelled" into an "archetype" and making it possible for the situation "without project" to be modelled.

3.4. Fields and surveys

The data used for the counterfactual scenario were collected in the control area during various visits in the region, between 2009 and 2012, where we conducted several types of surveys, including 34 historical interviews to understand the life stories of all male and female residents in the villages of the control area. The objective of these interviews was to understand the evolution of the cultivated landscapes, the agricultural practices and the relations between genders and generations within the domestic units over the last 50 years. The landscape analyses conducted with the same informants led us to identify the various cultivated ecosystems. In defining them, we paid particular attention to whether lands were flooded or rain-fed, to the spontaneous vegetation developing between two cropping cycles and, finally, to mode of exploitation of the ecosystem (particularly clearing and soil preparation practices). Lastly, we conducted nine detailed case studies to model a typical farming system for the Bolilands. Sampling for these case studies relied on the previous historical analysis. The latter revealed a form of differentiation during the last generations between small domestic units, often compelled to dispose of labour force, and larger domestic units, by contrast, which are able to attract labour force through various types of arrangements (Palliere et al. in press). For each case study, all active members of the domestic unit were interviewed: the headman, his wife or wives, and all dependent labourers (young men and women). Twenty-nine individual interviews, of which half with women, were conducted within the framework of these case studies.

4. Counterfactual scenario: dynamics of the agrarian system in the bolilands of sella limba

The Bolilands is a flat region. In dry season, even flooded and rain-fed lands are hardly discernible at first sight. Nevertheless, farmers take advantage of micro-topographic variations to spread the workload all along the working season and to mitigate the risk of crop failure. The aim of the following in-depth analysis of the family farming economy is to demonstrate how this strategy also allows family farming to generate more "jobs" at a regional level.

4.1. Landscape facets in the bolilands

Three facets make up the landscape mosaic of the Bolilands: village forest belts; wooded savannahs in rain-fed lands, and the large seasonally flooded basins characteristic of the region.

Village forest belts punctuate the landscape regularly, corresponding to current or former village locations. Fairhead and Leach (1996) have shown that they are not the remnants of some hypothetical original forest but are artificial vegetal formations or result from permanent human presence. In fact, they are dominated by fruit trees (mango, citrus and kola trees) or by fast-growing useful species such as the iconic "cotton tree" (*Ceiba pentendra*).

During the rainy season, the major river flows back in the tributaries, which then overflow flood basins from 300 m to 1 000 m or more wide. Their drainage also occurs through the tributaries. This water regime results first in faster flooding than for the swamps of the neighbouring hilly regions, and second in several flood peaks (2, 3 or more per rainy season). Only rice can be grown in these basins, and the water regime determines specific farming practices. Devoid of any arboreal vegetation, the basins typically contain hydrophilic grasses such as *Anadelphia leptocoma* or *Rhytachme rottboeliodes*. At the end of the dry season, the dry grass feed fires preparing the working season. Soils are light grey in colour with a sandy-clay texture.

Trees indicate the limit between flooded basins and rain-fed lands. They are covered by an herbaceous stratum (*Andropogon tectorum*, *Chasmopodium caudatum,* among others) associated with a more or less dense tree cover, where *Lophira lanceolata* and other slow-growing pyrophytic species dominate (Stobbs, 1963). Humid tropical lateritic-type soils are found here with a finer textured cultivated surface layer, the presence of lateritic gravel and a thick and deep layer of clay. Grass cover is burnt slightly earlier at the end of the dry season in rain-fed lands than in flooded basins.

4.2. History of the human settlement in the bolilands

A short history of the recent settlement of this region will show how different waves of newcomers progressively make use of this variegated topography. This history has resulted in contemporary complex farming systems.

All oral and written historical accounts testify to a relatively late settlement in the Bolilands. Migeod (1926) who travelled through the region in 1925 described an almost empty savannah, contrasting with the densely populated "jungle" he left further east. The 1:50 000 maps of the end of the 1950s (Directorate of Overseas Surveys, 1963) record present villages already, althoughthey used to be smaller.

In Sella Limba, the first inhabitants of the Bolilands are said to have been "sent" towards the end of the 1920s by the Paramount Chiefs to occupy lands to the west, in a context where colonial power were creating *ex-nihilo* chiefdoms as local political jurisdictions. The first inhabitants exploited the rare tree covers that lent themselves to slashing and burning, particularly the riparian forests along the major river. They entirely neglected the basins that were grazed during the dry season by the herds of cattle that, at the time, were part of a flourishing trade between Guinea and Freetown.

Agricultural colonisation dates back to the last years of the protectorate and the first years after the 1961 independence. At the time, Sierra Leonean rural society experienced rapid and deep transformations (Palliere, 2014; Rashid, 2009; Reno, 1995; Richards, 1996). Under the effect of the economic integration of the countryside, elders' authority weakened, and the large domestic groups broke into smaller units. New social relations between family members developed at the same time as new farming practices. The youth sought independent sources of income, particularly through regularly farming the low-lying flooded lands. Many of the young men, lured by the promise of rapid emancipation, fled their villages and parents to join diamond-mining areas in the east of the country. Others went to the Bolilands in search of land for cultivation and in the hope of marrying, a prospect that was refused to them in their village of origin. The first inhabitants of the Bolilands distributed the land and gave their daughters or sisters in marriage to newcomers to assert their control over the land and their role of leaders in these village communities in the making (Palliere, 2014).

Farming the flooded basins dates back to the arrival of these new migrants. To farm these new spaces, farmers pulled tufts of grass and burnt them a few days later when the grass had dried out, just before sowing rice at the time of the first rains and after scratching the surface layer. Under these conditions, each field was cultivated only once, and

four years went by without cultivation before the field was cultivated again. The cultivation of the basins necessitated the development of new tools (larger hoes to pull the grass) and new rice varieties (longer straws adapted to deep water level). This new technological kit seems to have been borrowed further west, where flooded basins of the Bolilands has been farmed for a longer time. Other cropping techniques (*infra*) for intensifying farming in the basins came at a later stage.

Beyond their diversity, all individual stories are characterised by a precarious existence and fluidity in social relations. Up to a recent past, the Bolilands functioned as a new territory, where major social tensions, resulting from the economic integration of old and densely populated neighbouring territories, could be solved. Even nowadays, young men can fled their homes, often as a result of a "sex case", and find shelter with a family member in the Bolilands. They can find land for cultivation and settle in a village where they can make a "new life" for themselves. Large scale land takeovers in Bolilands cause the definitive closure of these new territories under agrarian colonisation and may exacerbate social tensions in old, relatively densely populated, neighbouring areas.

Where the countryside keeps attracting news populations, farmers have established increasingly complex farming practices.

4.3. Complex farming practices adapted to a variegated cultivated environment

In the light of the preceding landscape and historical analysis, the farming practices in the two main cultivated ecosystems of the Bolilands will now be described. In a second time, their combination in space and time at the level of farming systems will give a picture of the complexity of the family farming that has been substituted by large scale sugar cane mono-cropping in the project area.

4.3.1. In the flooded basins

Only rice can be grown in the flooded basins. After burning the fields, cultivating the basins requires the grass to be manually uprooted by the farmers (*supra*), who then build ridges in which they bury the uprooted vegetal biomass. After one month, the field is levelled and the mixture of soil and decomposing organic matter is spread out. The farmers then transplant rice while flooding starts.

Crop rotations in the basins depend on the field position in the micro-topography. Towards the bottom of the basin, flooding comes early (July August), and the water recedes late (November-December). Farmers cultivate these lands continuously thanks to the fertility renewal enabled by the flooding. This is facilitated by the absence of powerful spontaneous vegetation which makes uprooting grass before ridging and weeding after transplanting unnecessary. However, the rapidity and severity of the water regime renders cultivating these lands risky. By contrast, at the edge of the flooded basin the fields are moist during the rainy season but never completely submerged. Here, two years of cultivation alternate with four years of natural spontaneous regrowth to renew soil fertility. Every time the field is cultivated anew, the grass must be pulled out. One or several weeding sessions are necessary after transplanting. Bottom lands and edges of the basin correspond to two extreme situations in between farmers adapt their practices and their schedule. The following figure schematises this gradient by representing three situations, from the bottom to the edge of the basin (Fig. 2).

4.3.2. In the rain-fed lands

Uprooting grass covers is also necessary to cultivate the wooded savannahs of the rain-fed. A job all the more difficult when the field has not been cultivated for a long time. The smallest trees are chopped down and others are "killed" using the girdling technique. Rice associated with many other plants is sown following a light soil scratching at the beginning of the rainy season. Once a field has been opened up in the wooded savannah, it can be cultivated for four years in a row. A long-cycle rice crop is favoured during the first year. Short-cycle rice, manioc or chili is preferred for the subsequent year

Opening up a new field in wooded savannah requires much work. Once cleared, the field is handed over to the women who integrate it into much faster rotations (see Fig. 3 below). They return to these fields every three to four years to clear the ground vegetation in preparation for cultivation. They then cultivate the fields for two years in a row, by sowing in turn groundnut, which is a commercial crop and an alternative to palm oil, and fonio, which is a typical local cereal with low yield but requiring very little work. Planting fonio only requires simple light scratching beforehand, unlike groundnut, which requires hoe ploughing. These two crops are short-cycled, and most of the tasks required occur during the rainy season. Crops are sowed in June, weeding in July and harvesting in August-September.

4.3.3. Combining different cropping systems at the production unit level

Each domestic unit in the Bolilands combines farming in flooded basins and rain-fed lands. The field cultivated in the wooded savannah contains a portion open during the current year and a portion open the previous year. The second field in the flooded basins is split up into several adjacent portions from the deepest part of the basin to its edge. Finally, women also have their own fields for groundnut and fonio in the savannah, often separately.

In dry season, farmers focus on uprooting grass to open up new portions of wooded savannahs or flooded basins to compensate for areas lying fallow in what are the oldest cultivated fields. This very hard work is carried out individually or in small teams during slack periods. Preceding the sowing period of the rain-fed fields, large work teams gather at the beginning of the rainy season (June) for ridging operations in the deepest portions of the flooded basins. The period from July until the beginning of August, in the middle of the rainy season, is the busiest. While farmers must transplant rice rapidly in the deepest portions of the already flooded basins, they need to continue preparing (i.e., ridging) those portions that will only be flooded a month later. Simultaneously, they cultivate the rain-fed fields in the wooded savannahs, where it is time for weeding in the fields, which is more important in second-year fields than in newly opened portions. In the second half of August comes the harvest of short-cycle fonio and groundnut. Rice harvests follow one another up until the beginning of the dry season: short-cycle rice in second-year fields in the savannahs and in the fields around the flooded zones, long-cycle rice in the rain-fed lands and finally long-straw rice in the low-lying portions of the basins. These harvests mobilise most of the labour force available during that period (Fig. 4).

In the Bolilands, farmers seek to take advantage of the diversity of the cultivated environment, from the top of the rain-fed lands to the deepest portions of the flooded basins. The objective is to maximise the cultivated area per labourer and therefore farm income, while farmers only have manual tools and lack access to any industrial farming input (fertilisers or pesticides). Every time a window of opportunity in the work schedule closes because a field is flooded or there is too much rain, a new window of opportunity opens up higher or lower in the topography. A brief period at the beginning of the dry season aside, a time suitable for harvesting and transforming palm oil as well aw traditional celebrations, the farmers' work schedule in the Bolilands is busy. In these conditions, a farm labourer cultivates approximately 1.25 ha every year, which, when taking into account the surface area of fallow lands included in the crop rotations, corresponds to approximately 5 ha/labourer. In this system, the value added per labourer represents approximately 600 € per year.[4]

The work schedule of the farm reflects the diversification of

[4] i.e., 3 300 000 Le in 2011, with the entire sold (e.g., chili) or home-consumed (e.g., rice) production being valued at local market price that year. For details on calculations and hypotheses, see Palliere (2014).

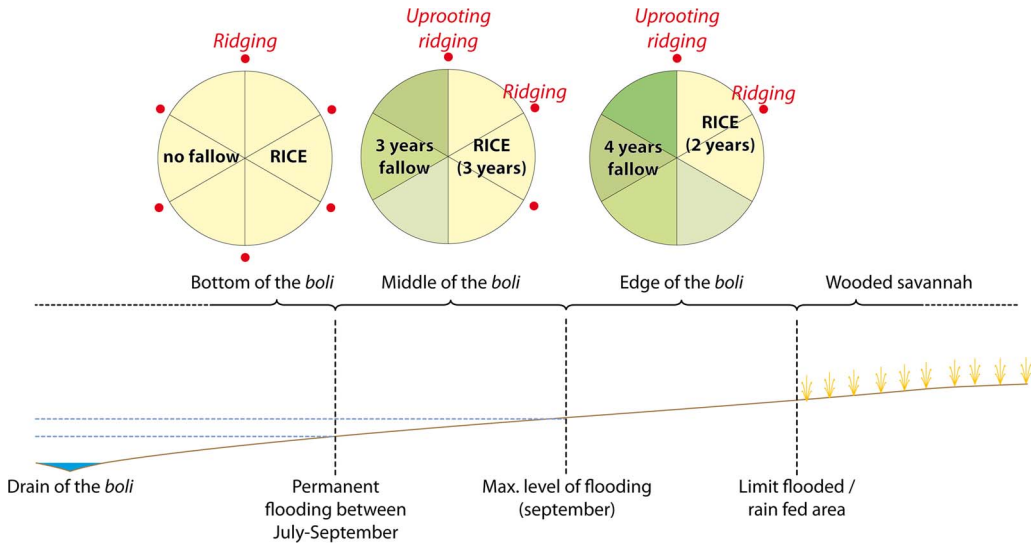

Fig. 2. Crop rotations and cropping practices in the flooded basins according to the position of the field in the topography.
Source: surveys (authors).

Fig. 3. Crop rotations and practices for opening wooded savannahs and their cultivation by women Sources: surveys (authors).

agricultural productions. The cereals consumed at home (flooded rice, rain-fed rice, fonio and cereals associated with rice) predominate and represent approximately 3/4 of the value added produced. Groundnut, chili, cassava flour (*gari*) and palm oil are all potentially marketed food products that we find in every domestic unit. Diversifying agricultural production is a resilience strategy in the face of agro-climatic and economic crises. Abrupt price variations on local markets actually renders the specialisation strategy recommended by public policies very risky (MAFFS, 2010).

5. Results: addax bioenergy project potential net job creation

Does substituting complex family farming with large scale sugar cane mono-cropping lead to job creation?

5.1. Jobs created by the sugar cane project

According to the project's preliminary impact study (CES, 2009), the implementation of the Addax BioEnergy project would lead to the employment of 2 200 permanent workers and 2 500 seasonal employees for cutting sugar cane. Baxter (2013) finds that the actual number of jobs created was between 1 444 and 1 669 Sierra Leonean employees at the end of 2011. Addax BioEnergy's website indicates that in March 2015 the project employed 3 600 people, without specifying the nature of the jobs.[5] At around the same time, the NGO SiLNoRF (2016) counted 3 850 national employees, and in details: 132 permanent workers paid on a monthly basis, 1 472 permanent workers paid on a daily basis and 2 234 casual workers.

Assuming that the agro-industrial unit would be working at full capacity, we decided to maintain the high and clearly over optimistic estimate given by the company itself at the beginning of the project, i.e., 2 200 permanent workers and 2 500 seasonal workers, or 4 700 jobs in total.

5.2. Farming jobs destruction due to lands takeover by the project

Fields and infrastructure represent 15 500 ha. In this type of ecosystem each farm labourer cultivates approximately 5 ha, taking into account surface areas lying fallow every year. On that basis, we can therefore estimate that 3 100 farm labourers would have been able to work on the lands attributed to the company behind the Addax BioEnergy project in the south Bolilands.

A more in-depth spatial analysis worsens this first estimate. Chouquer (2013), by analysing available satellite pictures and maps, shows that the villages residents directly impacted by the project will only be left with "disconnected strips" of territory (Fig. 5). The project consists in a set of circular pivot-irrigated fields of approximately 70 ha. To minimise the social and ecological impacts, the pivots were placed in such a way as to avoid residential areas and watercourses. The result is that residents have been deprived of only a part of the space they used to develop. The consequences of this partial amputation extend beyond the pivot-irrigated surface areas dedicated to sugar cane. While farmers

[5] www.addaxbioenergy.com, accessed on 7 May 2016.

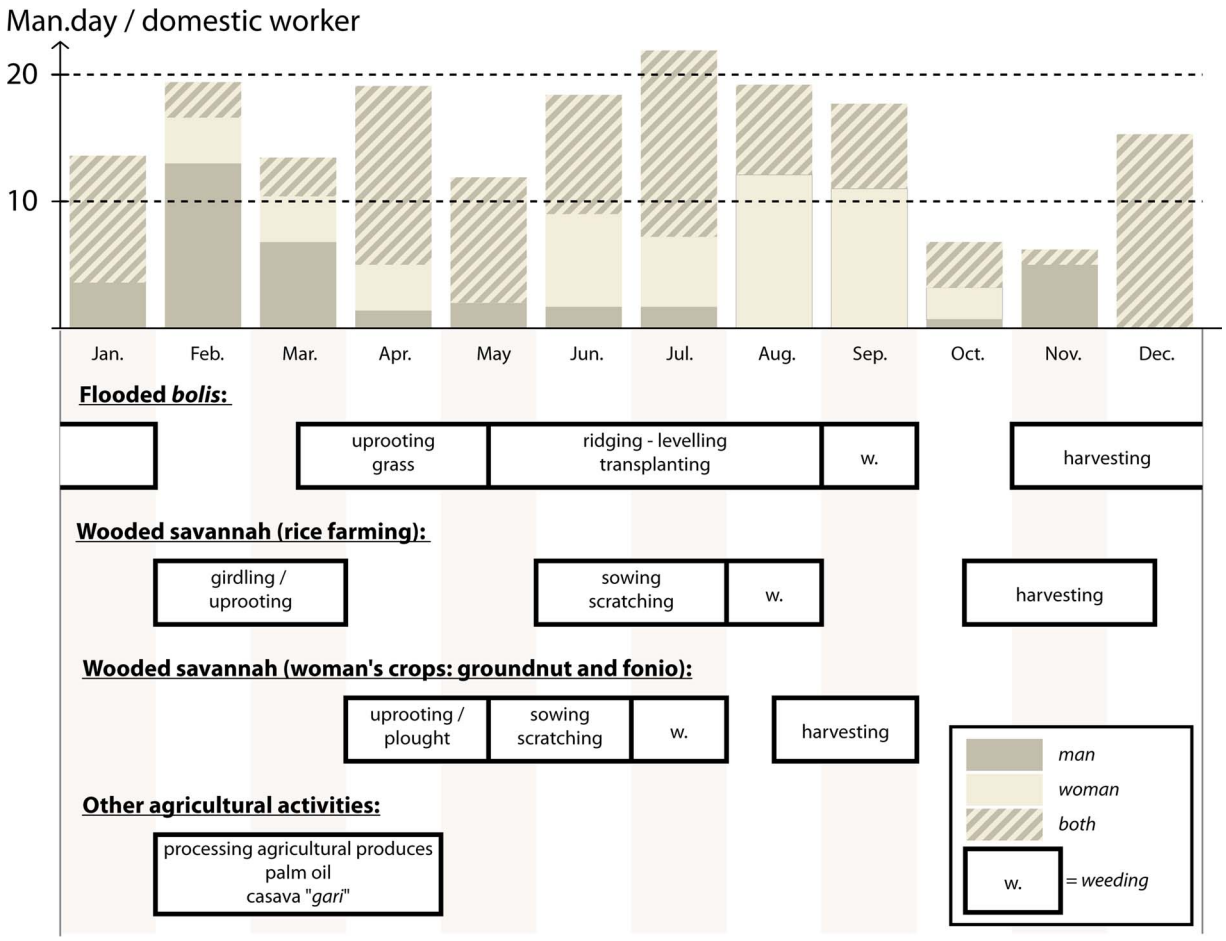

Fig. 4. Simplified work schedule of a typical domestic unit in the Bolilands. Data are given in proportion to the number of labourers: domestic units comprise from 2 and 10 labourers (Palliere, 2014). In the typical farming system displayed above, cultivated surface areas represent 0.35 ha per labourer in the basins, 0.6 ha of rice-growing in the wooded savannahs, and 0.30 ha of women's crops in the wooded savannahs.
Source: authors' surveys.

try to make the best of topographic variations and the landscape mosaic by combiningdifferent cropping systems adapted to each ecosystem, mechanised sugar cane mono-cropping requires as homogeneous an environment as possible. An examination of the maps supplied by the impact study and of the satellite images seems to indicate that the irrigation pivots are situated in the privileged position at the interface between the flooded basins and the rain-fed lands, i.e., between the low-lying portion of the flooded basins and the top of the rain-fed hills. By monopolising in this way only part of the cultivated environment, the establishment of the pivots probably restricts or even prevents neighbouring fields from being farmed.

In addition to the issue of spatial forms, i.e., the "interstices" (ibid.) left to the populations by Addax BioEnergy lies also the issue of the way the environment is farmed. The farming techniques implemented by Addax BioEnergy are fundamentally different from those farmers have implemented these last decades in the Bolilands. Crop rotations are planned every six years: sugar cane, harvested once a year for five years, alternates with soya intercropping. Thanks to the use of artificial fertiliser, irrigation during the dry season and techniques described as being the most "modern", expected yields range from 80 to 90 t/ha. Many facilities are needed to farm the lands conceded, and the project seeks optimum and homogeneous conditions for sugar cane mono-cropping to succeed. According to the impact study (CES, 2009), in addition to the complete removal of stumps, preparing the circular fields around the pivots requires ground levelling operations, mainly intended for irrigation infrastructures and for the passage of agricultural machines.

As it is difficult or impossible for the villagers to develop the interstices remaining between the fields of the agro-industrial plant we assessed the total surface area impacted by the project and therefore the total number of farming jobs threatened by the project.

The lease concerned 57 000 ha, but the company did not envisage extending the farm over this entire surface area once the project was established (CES, 2009). The impact study in fact only targeted a 33 500 ha area. A measurement of the surface area occupied by the pivots and their interstices on the available satellite images, in March 2016, shows a surface area of approximately 20 000 ha.

According to these estimates from 4 000–6 700 farm labourers would have been to make a living in the project area. It can be assimilated as permanent "jobs" loss causes by the project implementation. Considering the number of jobs actually created by the industrial company — 4 700 jobs at best, of which 2 500 seasonal — we can see that the results appear in either case greatly in deficit and that the project is likely to result in net job destruction.

6. Conclusion: from the promise of job creation to farmer eviction

The promoters of large private or public agricultural projects explicitly or implicitly assume that the opportunity cost of the land and the labour force is very low and even zero in the regions where projects are implemented. This is the case in Sierra Leone, where the official discourse describes arable land as being widely available, and where "jobs" offered by agro-industrial corporate farms are net job creations. This assumption fails to be contradicted by environmental and social

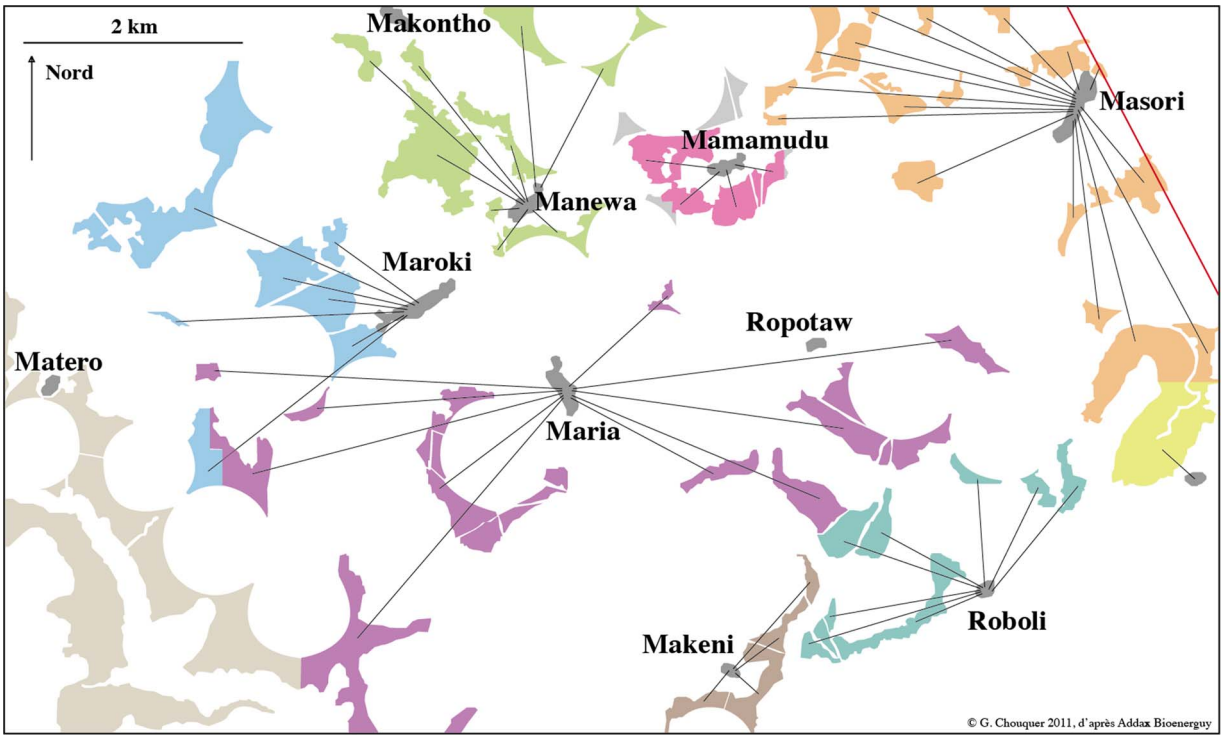

Fig. 5. "Interstices" left to farmers between pivots.
Source: Chouquer (2013) (with the kind authorisation of the author).

impact studies that only superficially consider counterfactual scenarios. This article aimed to show that a detailed characterisation of complex and diverse practices of family farming may contradict this all-too-convenient vision. This is particularly the case in the region of the Bolilands where the sugar cane farming project coupled with an ethanol production unit operated by Addax BioEnergy is likely to result into net job loss.

Beyond the issue of "net" job creation or destruction, the nature of jobs created and destroyed may be analysed. To favour the establishment of large-scale corporate farms on its territory, the government of Sierra Leone put forward low cost of labour. This follows the investors' reasoning that to maximise profits, labour's share of the value added must be reduced (Cochet, 2017). Unskilled workers, such as labourers or security guards,[6] in large private farms earn the minimum wage, which is that of gold or diamond miners (i.e., between 10 000 and 15 000 Le/day). This minimum wage is determined by the level of productivity of the poorest and most poorly equipped peasants (Mazoyer and Roudart, 2006). Baxter (2013) observed that, in the large capitalist farms of Sierra Leone in 2012 those of Addax BioEnergy in particular, labourers earned between 250 000 and 350 000 Le per month. This rough estimate equals the value added each year by a farm labourer in the Bolilands. As a result, insecure and poorly paid jobs are created, often to fulfil the need for a seasonal labour force during cropping operations for which mechanisation is not cost-effective, while "jobs" within family farming are destroyed.

We must also take into account the dynamics observed in the Bolilands before the project was established. Populations have settled in this natural region since the 1950s–1960s. Without any public support, farming gradually intensified with the adoption of labour-intensive cropping practices, such as ridging or rice transplanting in the basins. In the absence of cultivated lands closure, the most likely trajectory is that natural and migration-related population growth would continue, and farming intensification, mainly through labour, would allow more people to make a living in the Bolilands. Family farming would led to the creation of more jobs.

However, family farming and living conditions in present Sierra Leonean rural areas should not be idealized. Manual farming work is very hard, health and education services in remote rural areas are more than rudimentary and elders keep control over youth destiny. Urban way of life appears as a desirable horizon for young men and women in search of emancipation. They invest a great deal of time and energy in their own education at school or in apprenticeship to find a job in Freetown or in other urban centre. Under such circumstances are youth and future generations willing to engage their lives in farming as implicitly supposed in the counterfactual scenario? The question may be: do they have better alternatives? For now, industry and services sector do not offer it in Sierra Leone, as in Sub-Saharan Africa as a whole. Unlike other regions of the world, urban growth is far from absorbing population growth. And agriculture will have a key role to play for youth employment in the coming decades (Gendreau, 2010).

As regards employment, host or target countries' policies to favour corporate farming rather than family farming, deemed inefficient, is fraught with unwelcome consequences. Large-scale, specialised and well-equipped corporate farming does not seem able to meet the major issues of agricultural employment around the world and especially in Sub Saharan Africa.

Under-employment, including that of qualified youth, is a major problem everywhere and constitutes a great challenge for the decades to come in Sub-Saharan Africa. Under these circumstances, "creating jobs" may mean favouring the development of family farming that offers people a better life thanks to complementary cropping systems, which ensure that the family labour force is active throughout the year, and thanks to more resilient and diversified farming systems, less costly in farming input and equipment that favour the remuneration of labour rather than capital.

Not long after starting operation, Addax experienced unforeseen technical and financial challenges. The company scaled down operations and finally the mother company transferred the ownership to

[6] According to the impact study, sugar cane must be harvested mechanically 7 out of 12 months a year (CES, 2009).

another investor, SunBird Bioenergy. Workers have been made redundant, but land access is still closed to farmers (SiLNoRF, 2016). Most likely, earlier than expected, Sierra Leone is faced with the challenge of generating sustainable jobs in rural areas while promoting free movement of capital. This failure exemplifies the unequal sharing of the added value in a type of agriculture where capital and labour are set apart (Cochet 2017).

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