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Participatory foresight to address long-term issues in a large irrigation scheme. An example in *Office du Niger*, Mali

T. Hertzog [a,*], J.-C. Poussin [b], B. Tangara [c], J.-Y. Jamin [d]

[a] CIRAD UMR G-Eau TA C-90/15 73, rue JF Breton, 34398 Montpellier Cedex 5, France
[b] IRD UMR G-Eau Campus ISRA IRD de Bel Air, Route des Hydrocarbures, BP 1386, CP 18524 Dakar, Senegal
[c] IER ESPGRN, CRRA de Niono, Mali
[d] CIRAD UMR G-Eau TA C-90/15 73, rue JF Breton, 34398 Montpellier Cedex 5, France

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1. Introduction

Large-scale investment projects in agriculture have been increasing in sub-Saharan Africa, especially since the 2007–2008 world food price crisis (Cotula, 2013). Largescale land acquisitions by foreign or national investors raise questions about land grabbing (von Braun and Meinzen-Dick, 2009), which is a complex and controversial concept (Teklemariam et al., 2015). Irrigable areas are particularly coveted (Smaller and Mann, 2009; Mehta et al., 2012). Investment projects for the development of irrigated agriculture are increasing at an unprecedented rate (Cotula, 2013), especially in Mali, Niger, Senegal and Ghana (Woodhouse, 2012). In these locations, access to water requires major investments in irrigation infrastructure whose financial effectiveness can only be ensured through an intensive agricultural system with high added value products (Jamin et al., 2011). Hence, irrigation significantly increases the value of land that was, as "dry land", previously devoted to rain-fed agriculture, forestry or breeding (Clark, 2013). Furthermore, large scale investment projects raise the question of land availability per capita and fair access to land and water resources between current and future users (Scoones et al., 2014). This could significantly increase competition among land users in irrigable areas (Mishra, 2011) or dry lands (Sulieman, 2015). As a consequence, the expansion of irrigated areas means existing water and land use policies have to be adapted to the territories concerned. Addressing such policy issues requires understanding and anticipating the interactions of often cross-scale drivers of land and water grabbing and their possible consequences.

Scenarios are used in various domains: the environment (e.g. Rotmans et al., 2000; Alcamo et al., 2007; Moss et al., 2010), land use (Verburg et al., 2006), and policies (Kuhlmann, 2001; Nelson et al., 2010). Reviews can provide an overview of recent developments in scenario approaches (Bradfield, 2005; Varum and Melo, 2010) and identify scope for improvement (Foran et al., 2013). Examples of scenario development already exist in irrigated areas to deal with the conditions and consequences of new irrigation technologies (e.g. Enfors et al., 2008, in Tanzania; Imache et al., 2009, in Algeria).

Anticipating the future impacts of large scale projects in an irrigated territory involves two types of challenges. The first is to understand the dynamics of land grabbing, especially the local consequences of decisions made by international investors. The second challenge is to project them into the future in a way that is sensitive to policy levers and irrigation planning.

Involving stakeholders in the scenario building process is considered as an innovative way to produce valid scenarios (Loveridge, 2008; Chakraborty, 2011). Such approaches have recently been

* Corresponding author.
E-mail address: thomas.hertzog@yahoo.fr (T. Hertzog).

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applied in Africa (Kok et al., 2006; Malinga et al., 2013). Participatory foresight approaches also make sense in the context of land grabbing, because of the determination of the stakeholders to be part of the debate (Hall et al., 2015) and the interest of taking the farmers' strategies facing land deals into account in policy making (Suhardiman et al., 2015).

Participatory scenarios have rarely been used in large irrigated areas in Africa. First, the management of large irrigation schemes was long considered closely allied with political power and thus rooted at state level (Downing and Gibson, 1974). Second, the involvement of water users in irrigation management has been progressive and is only recent (Meinzen-Dick, 1997). And third, the hydraulic and economic dimensions still had priority over all other aspects (Rinaudo et al., 2012; Pavelic et al., 2012). Foresight studies in developing countries are therefore generally conducted by a small group of official decision makers and external experts, who are the only people considered to have the necessary competence to foresee the future of irrigation schemes. However, Chaudhury et al. (2013) highlight three main reasons why bringing stakeholders into reflective processes about their future is important: (i) it encourages and provides space for multiple perspectives, (ii) it allows different perspectives to be captured in policies, and (iii) it facilitates acceptance of policies as co-constructed and thus as legitimate and relevant to more people and constituencies.

In this paper, we present a method of participatory scenario development in a context of land grabbing in a large irrigable area in West Africa. We developed a method to explore possible land use changes in Mali, where large scale investments over hundreds of thousands of hectares were planned. The method was implemented with several types of stakeholders. The two questions we aimed to answer were: (1) In developing countries, what kind of process could enable different stakeholders to build and assess long term scenarios? (2) Can this method produce outputs which are useful for policy makers?

2. Case study background

The *Office du Niger* area (hereafter ON area) has been geographically delimited since 1932 as the land area potentially irrigable by gravity from the Niger River; it covers about 1.9 million hectares. A decree delegated the management of the whole area to the public operator *Office du Niger* (hereafter ON operator) whose headquarters are in Segou, 250 km northeast of Bamako, the capital city of Mali. During the colonial period, the ON area was devoted to the production of irrigated cotton and rice, and lands were developed progressively through the expansion of the irrigation and drainage systems. In 2011, the area developed for irrigation (hereafter ON scheme) covered about 110,000 ha (6% of the ON area), of which 96% were cultivated (rice and vegetables) by family farmers and 4% by a sugar cane company.

2.1. Involvement of farmers in land and water management

The ON operator has considerable power of decision over land and water management in the ON area, especially its irrigated part. The remaining dry lands (94% of the ON area), which are used for rainfed crops (pearl millet, sorghum, etc.), forestry and livestock (Brondeau, 2011), are managed according to customary law.

The ON operator supervises land allocation and manages water from its withdrawal from the Niger River to delivery to tertiary canals. Until 1994, the ON operator closely supervised the production of irrigated crops by farmers, including processing and marketing (Schreyger, 1984). When rice trade was liberalized in 1986, farmers' organizations were also created (Couture et al., 2002), and in 1994, the ON operator was profoundly restructured (Aw and Diemer, 2005). Nowadays farmers are involved in water users' associations each of which manages about 1,000 ha. Farmers also have representatives in joint water and land management committees, each of which manages about 5,000 ha, and three delegates on the ON board of trustees, where they participate. In addition, the Chamber of Agriculture and different regional and national producers' unions defend the farmers' interests.

2.2. Future uncertainties

At the end of the 1980s, the ON scheme became "Mali's rice bowl" (Bonneval et al., 2002). At the time, its development was based on a family farming model: 40,000 family farms, each cultivating from one to three hectares. As the rate of land development did not keep up with the pace of population growth, the average size of farms progressively decreased. This resulted in an increasing number of farms of less than 1.5 ha, which were not viable, along with a reduction in the per capita income and migration to urban centres (Bélières et al., 2011; Roudart and Dave, 2013).

Faced with the lack of donors' aid to develop irrigated land for family farmers, the Malian land policy changed in the 2000s, encouraging Malian and foreign, public and private investors, to develop and cultivate new lands in the area (Adamczewski et al., 2015). The government set up a dedicated ministry, MDDIZON (*"Ministère Délégué auprès du Premier Ministre chargé du Développement Intégré de la Zone Office du Niger"*), fully devoted to the development of the area and mandated to supervise land allocation. However, land continued to be mainly allocated through informal and fragmented negotiation processes (Hertzog et al., 2012).

As a result, in 2011, more than 700,000 ha (i.e. about seven times the current developed area) were already allocated, or in the process of allocation, to investors. A total of 32 investment projects, ranging from 2500 to 100,000 ha each, were inventoried, related to all types of land use changes as described by Borras and Franco (2012) (Table 1).

These new investors can obtain long term leases (50–99 years, whereas family farmers can only obtain annual cultivation contracts) over dry lands considered to be unoccupied and ownerless (*terra nullius*) (Adamczewski et al., 2015).

Beyond the technical issue of meeting the future water demand for irrigation by taking water from the Niger River (Hertzog et al., 2012), a major expansion of the scheme could have important social consequences. These were already illustrated by local protests (such as the Farmers' forum on land grabs in Mali held in 2010, http://farmlandgrab.org/17414). This situation could result in a rupture between development policy and farmers' wishes and increase future uncertainties.

3. Methods

3.1. Building scenarios using an actor-focused approach

Scenarios, defined as internally consistent narratives of possible futures, are considered to be "most useful in situations of high uncertainty and considerable ignorance about causality constraining action to resolve problems" (Gallopin, 2002). Börjeson et al. (2006) distinguish three types of scenarios: (i) "predictive" in response to "what will happen?", (ii) "exploratory" in response to "what can happen?", and (iii) "normative" in response to "how can one reach a specific target?". In our context, we chose to build "exploratory" scenarios in order to imagine a wide range of possible futures in line with the "culture of curiosity" promoted by van Notten et al. (2005). A 20-year horizon was chosen for the scenarios. This horizon was far enough ahead to account for the time needed to complete the investments and to help the stakeholders to step