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A public–private partnership experience in the management of an irrigation scheme using decision-support tools in Burkina Faso

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ABSTRACT

Within the framework of a national policy on food sufficiency dating back to the late 1960s, a 1200 ha State-run irrigated rice scheme, called the 'Kou Valley' scheme, was established in south-western Burkina Faso. Jointly managed over a long period by State officials and a series of international development agencies, all aid ended abruptly in 1993, leaving the farmers and their hastily assembled Water Users Association (WUA) poorly prepared to assume management of the scheme.

Concerned about the poor state of the water management and aware of their lack of management skills, the WUA turned to a private external operator for support via a public–private partnership (PPP), which involved outsourcing the water management. Initially, the PPP was funded and assisted by an international development agency. The costs are now gradually being met by the WUA and will ultimately represent 12% of the water fees collected from WUA members. An irrigation advisor was appointed on a full-time basis, and technical studies were conducted to assess the water management problems and put forward viable solutions using decision-support tools (SIMIS).

At various stages, participatory meetings were organised to enable the farmers to express their opinions and to propose and discuss possible solutions. After 3 years, there was some improvement in the land occupation situation and the water distribution was more equitable in some parts, as shown by various performance indicators and a general survey. However there are limits to what water management change alone can achieve without essential infrastructural improvements.

As the WUA members lacked the necessary education, effective knowledge transfer was not possible and therefore assistance on water management is likely to remain in private or State hands. The farmers, however, have indicated their satisfaction with the proposed approach and their willingness to participate in PPP-based management of the scheme.

1. Introduction

Within the framework of a national food sufficiency policy dating back to the late 1960s, a 1200 ha State-run irrigated rice scheme, called the 'Kou Valley' scheme, was established in south-western Burkina Faso. Jointly managed over a long period by State officials and a series of international development agencies, the scheme worked well for much of the time. Construction began in 1969, first by Taiwan and then China, and the scheme was managed in a rather colonial fashion until 1979. Then there were several phases of Dutch technical assistance, ending in 1993. It was during this time that the Water Users Association (WUA) was set up to manage the scheme in a cooperative way. The ending of the technical assistance, however, combined with World Bank and IMF structural adjustment programmes (SAPs) that favoured privatisation, forced the management of the scheme to be rather hastily transferred to the new and inexperienced WUA.

As in many cases where top-down non-stakeholder initiatives are prematurely abandoned (Subramanian et al., 1997; Meinzen-Dick et al., 2002; Nkhoma et al., 2004), the outlook for the WUA was not good. Maintenance work declined, yields started falling and an increase in upstream water use made it harder to meet the overall water needs, resulting in many farmers abandoning their plots.

Concerned about the poor state of the water management and aware of their lack of management skills, the WUA turned to a private external operator, the Association Eau Développement et Environnement (AEDE), for support. Drawing on its experience in the rural water and sanitation sector (Valfrey and Diallo, 2004), the AEDE initiated a range of actions.

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A full-time irrigation counsellor was appointed to the scheme. His presence helped the farmers regain confidence in the scheme and resulted in a more technical assessment of the problems facing the scheme, based on research and farmer testimonies. Later, more technical studies were conducted to assess the water problems and propose sustainable solutions, including: mapping the scheme and creating a database, proposing more efficient land use, evaluating the water distribution through a set of efficiency parameters, and adapting the FAO SIMIS software tool (Mateos et al., 2002) for designing more efficient and equitable water distribution.

Essential to this approach was the gradual construction of a management structure, as opposed to setting one up immediately. Initially, from 2006 to 2010, the AEDE activities were sponsored and technically assisted by the Association pour la Promotion de l'Education et de la Formation à l'Etranger (APEFE) and Wallonie–Bruxelles International (WBI). Subsequently, a contract was established whereby these irrigation management costs were negotiated between all the stakeholders (WUA, State officials and AEDE) and would be gradually taken over by the WUA. With the process completed in 2013, this public–private partnership (PPP) would cost the WUA 12% of their actually collected annual users' water fees. Since the water fee collection ratio seldom exceeded 60% (Dembélé et al., 2011), the AEDE plans to accompany the WUA in raising farmers' awareness and contributions.

This paper describes the successful participatory establishment of a PPP based on the 'outsourcing through service or management contracts' model (World Bank, 2007). Since the transfer of the irrigation and drainage infrastructure to the WUA, the water services have been managed well, although there have been difficulties with water distribution. This paper opens with a diagnosis of the *ex-ante* irrigation practices and efficiencies, and then describes the use of decision-support tools to improve land use and water distribution, based throughout on participatory meetings. It concludes with an assessment of the *ex-post* situation and the changed role of the various stakeholders.

2. Materials and methods

2.1. Description of the study area

The Kou Valley region (11°23′N; 4°25′W) is characterised as subhumid (Wellens and Compaoré, 2003). The annual rainfall varies from 600 to 1200 mm and is concentrated in the months from June to October. Reference evapotranspiration reaches 1700 mm a year and varies from a mild 4 mm/day (August–December) to a scorching 7 mm/day in March. The soils fall into the following groups: clay, loam, clay loam, sandy clay loam, sandy clay and sandy loam ('Projet Vallée du Kou' (1986), cited by Wellens et al., 2007). Paddy rice is the principal crop, followed by maize. There are two distinct growing seasons on the plain: the rainfed or humid period from July to October and the irrigated or dry season from January to June. Since no water shortages have been reported during the rainy season, the study focuses on the irrigated season when demands for water peak and shortages can become almost chronic.

The irrigation scheme takes its water from an upstream headwork. During the dry season, the Kou river is diverted, in its entirety, towards the scheme. Only in the rainy season does the river regain its continuous flow. At the time that the scheme was constructed, the notion of environmental flow did not exist and none of the water users occupied the area downstream of the headwork. From the headwork water is gravitationally conveyed via an 11 km-long lined canal to the scheme, at a rate of 3.5 m^3/s in the rainy season and an average of 1.4 m^3/s during the dry season. Thereafter, a hierarchical canal system allocates the water over the 1200 ha area of the scheme. A primary canal encircles the scheme and redistributes the water along eight secondary canals (referred to as 'blocks') and then along tertiary canals. The average plot size is 1 ha. Irrigation is semi-rotational: on one day the water is divided amongst the first four blocks, and on the next day the four remaining downstream blocks are served.

There has been a vast increase in upstream water users, some of them 'freeloaders', whose activities have had an adverse effect on the efficiency of the scheme provoking sometimes up to 25% of water losses, leading to friction between the upstream and downstream users as many of the latter now often facing water shortages. This has resulted, in turn, in the abandonment of almost a quarter of the fields and drops in yield (IWACO/BERA, 1988; IWACO/BURGEAP, 1998a,b; Wellens et al., 2007, 2009).

2.2. Performance indicators

Amongst the comparative indicators for the performance assessment of WUAs and irrigation systems presented by the International Water Management Institute (IWMI; listed in Uysal and Atiş, 2010), those proposed by Molden and Gates (1990) are widely used (Jahromi and Feyen, 2001; Unal et al., 2004; Vandersypen et al., 2006; Kazbekov et al., 2009). For this study, performance was assessed using their indicators of adequacy (P_A), efficiency (P_F), dependability (P_D) and equity (P_E). The indicators compare the volume of water required (Q_R) with the water delivered (Q_D) in a certain sub-region (R, the sampled tertiary and secondary blocks) during a certain period (T, the period of February–April). CV is the coefficient of variation.

The objective of *adequacy* (P_A) focuses on the desire to deliver the required amount of water over the command area served by the system:

$$P_A = \frac{1}{T}\sum_T \left(\frac{1}{R}\sum_R p_A\right) \quad \text{with} \quad p_A = \frac{Q_D}{Q_R}, \quad \text{if} \quad Q_D \le Q_R \quad \text{and} \quad p_A = 1 \quad \text{otherwise} \tag{1}$$

where Q_D is the water delivered; Q_R is the water required; T is the study period; and R is the region under study.

The objective of water delivery *efficiency* (P_F) embodies the desire to conserve water by matching water deliveries with water requirements:

$$P_F = \frac{1}{T}\sum_T \left(\frac{1}{R}\sum_R p_F\right) \quad \text{with} \quad p_F = \frac{Q_R}{Q_D}, \quad \text{if} \quad Q_R \le Q_D \quad \text{and} \quad p_F = 1 \quad \text{otherwise} \tag{2}$$

where Q_D is the water delivered; Q_R is the water required; T is the study period; and R is the region under study.

An indicator of the degree of *dependability* (P_D) of water delivery is the degree of temporal variability in the ratio of the amount required that occurs over a region:

$$P_D = \frac{1}{R}\sum_R CV_T\left(\frac{Q_D}{Q_R}\right)$$

where Q_D is the water delivered; and Q_R is the water required; T is the study period; and R is the region under study.

If *equity* (P_E) is interpreted as the spatial uniformity of the relative amount of water delivered, then an appropriate measure of performance relative to equity would be the average spatial variability of the ratio of the amount delivered to the amount required over the time period of interest:

$$P_E = \frac{1}{T}\sum_T CV_R\left(\frac{Q_D}{Q_R}\right)$$

where Q_D is the water delivered; Q_R is the water required; T is the study period; and R is the region under study.