STRATEGIC FRAMEWORK FOR AGRICULTURAL WATER



Initiative pour l'Irrigation au Sahel

September 2017

Burkina Faso | Mali | Mauritania | Niger | Senegal | Chad

STRATEGIC FRAMEWORK FOR AGRICULTURAL WATER IN THE SAHEL

September 2017

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TABLES OF ACRONYMS AND ABBREVIATIONS

2iS	Sahel Irrigation Initiative
ANFICT	National Local Authority Financing Agency
AWUO	Agricultural Water User Organizations
CAEMC	Central African Economic and Monetary Community
CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
DAM	Autonomous Maintenance Division
DPM	Delegated Project Management
ECCAS	Economic Community of Central African States
ECHO	European Commission Humanitarian Aid Office
ECOWAS	Economic Community of West African States
EIG	Economic Interest Grouping
EPIC	Public Industrial and Commercial Institution
FISAN	Food and Nutrition Security Investment Fund
GW	Groundwater
IPRODI	Local Irrigation Program in the Niger River Inland Delta in Mali
IS	Irrigated Systems
LAs	Local Authorities
LCBC	Lake Chad Basin Commission
NBA	Niger Basin Authority
OERT	Organization for the Maintenance of Office du Niger's Tertiary Networks in Mali
OMVS	Senegal River Development Organization
ON	Office du Niger
ONAHA	National Hydro-agricultural Development Agency
PAHA	Hydro-agricultural Development Program
PAP	Project Affected Person
PDIDAS	Project for Agribusiness Inclusive and Sustainable Development in Senegal
PMN	Programme Mali Nord
POs	Producer Organizations
PPP	Public Private Partnership
RAID	Regional Association for Irrigation and Drainage in West and Central Africa
RCI	Republic of Cote d'Ivoire
ROPPA	West Africa Farmer and Producer Organizations' Network
SAED	National Company for Development and Exploitation of the Senegal River Delta Lands
SAGIs	Public Irrigation Development and Management Agencies
SIS	Small Irrigation Scheme
SODAGRI	Senegalese Company for Agricultural and Industrial Development
SODELAC	Lake Development Company
SONADER	National Rural Development Company
SPIN	Small-scale Irrigation Strategy in Niger
SVS	Small Vegetable Schemes
TFP	Technical and Financial Partner
USDA	U.S. Department of Agriculture
VBA	Volta Basin Authority
VIS	Village Irrigation Schemes
WAEMU	West African Economic and Monetary Union

Preamble

On October 31, 2013, a High-Level Forum on Irrigation in the Sahel was held in Dakar at the invitation of the Senegalese President, His Excellency Mr. Macky Sall, and the World Bank Vice-President, Makhtar Diop, in the presence of the Executive Secretary of CILSS, Mr. Djimé Adoum, as well as ministers representing six Sahelian countries - Burkina Faso, Chad, Mali, Mauritania, Niger and Senegal. The forum's purpose was to give new impetus to the development of water control for agriculture, in order to increase the Sahelian countries' resilience to climate shocks and to accelerate agricultural intensification. This Forum concluded with the adoption of a Declaration calling for the mobilization of actors and partners to revitalize irrigated agriculture, and to allow it to play a driving role in the six countries' agricultural development.

The Sahel is one of the world's most vulnerable regions to climate change and variability with agriculture, which is 97 % dependent on rainfall, being the dominant sector in its economy. Food and nutrition insecurity as well as income instability are significant obstacles to economic and social development and result in high levels of poverty, particularly in rural areas, and increased migration and rural exodus, threatening the region's stability and security. However, the Sahel has comparative advantages: a lot of sunshine, major rivers, abundant water resources during the rainy season that need to be mobilized and managed, a fast-growing urban demand, and a gradual structuring of the agricultural sector.

In this context, the Dakar Declaration calls for “significantly increasing investments in agricultural water projects in order to move from the present 400,000 ha to 1,000,000 ha by 2020”. It recommends "ensuring that all hydro-agricultural developments are based on appropriate sectoral policies and strategies, which are integrated into a value chain and on a rational and sustainable use of available resources."

The present Strategic Framework (SF) and its complement, the Regional Action Plan, have been developed by a CILSS-coordinated regional Task Force (Annex 1), which represents the diversity of irrigated agriculture stakeholders and the governments of the six States. These documents examine the issues related to irrigated agriculture. They establish a vision shared by the Member States and their partners, and a method to enhance the performance of irrigated agriculture and accelerate the expansion of areas under water control. They set an intervention framework for the commitment of actors around this vision and this method, and detail this framework in concrete and operational recommendations. Finally, they express the regional commitment necessary to manage shared water resources, pool knowledge, produce decision-support information, and advocate for the financing of irrigation projects.

All partners of agricultural water in the Sahel are called upon to contribute alongside CILSS to the construction of this common vision for irrigation development in the Sahel to the benefit of operators and the six countries' economies - a vision where hunger in the Sahel is not inevitable because effective and sustainable irrigation is possible.

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Executive Summary

➢ *A joint initiative driven by a shared vision*

The Sahel Irrigation Initiative (2iS) is a joint initiative of six Sahelian countries, coordinated by CILSS, supported by regional economic communities (ECOWAS, UEMOA) and sponsored by the World Bank. It is a follow-up to the Dakar Forum on Irrigation in the Sahel held in October 2013. The Forum was concluded with the adoption of a Declaration by the Governments of Senegal, Mauritania, Mali, Burkina Faso, Niger and Chad and their partners.

The goal of this Initiative is to support Member States and actors in irrigated agriculture to increase the area under agricultural water control to one million hectares while ensuring the viability, performance, and environmental sustainability of existing and future irrigation systems and their associated agricultural development.

The vision underlying the Sahel Irrigation Initiative (2iS) as described in this Strategic Framework is highly ambitious. Based on the Sahel countries' long experience in water control, various irrigation solutions adapted to the Sahelian context can be designed, set up, and funded as part of an enhanced institutional framework with a view to permitting the development of sustainable irrigated agriculture suited to the environment that is competitive and inclusive.

The Framework is therefore a strategic and technical reference within which complementarity and synergy between actions and initiatives taking place in these six countries can be adapted in the long term for the concrete implementation of irrigation projects and programs following a shared baseline of effective methods, tools, and processes that can be replicated over time and space and based on diverse irrigation solutions.

The Strategic Framework is the outcome of a concerted process marked by the strong involvement of many actors coming together in a regional Task Force established in the wake of the Dakar Forum. It defines concrete methods for reaching the objectives of the Dakar Declaration according to a process that remains consistent over time not just in terms of successive new development and revitalization projects for existing systems but also of all aspects promoting the effective and inclusive development of irrigation in the Sahel. Its implementation will be supported by a regional project funded by the World Bank.

➢ *A Historic Opportunity*

Sahelian agriculture faces extreme climate variability exacerbated by climate change. The agricultural sector's share of these countries' domestic product and rural employment makes them vulnerable to climatic shocks. At the same time, population growth and rapid urbanization present a unique opportunity for growth as long as the products of Sahelian agriculture are competitive and supplant imports. The Sahel's climate also offers opportunities for seasonal exports to coastal countries around the Gulf of Guinea and beyond.

Historically, many forms of partial control over water, including seasonal lowland and flood-recession cultivation, zai, etc., were developed to reduce farmers' exposure to variability in rainfall. Transhumant pastoralism holds an important place in these production systems. In the 1970s, Member States committed major investments to developing areas under total water control (through irrigation and drainage) based on large-scale projects. These structuring investments, which require far more formalized land and water management methods and have major impacts on the environment and societies, struggle to achieve a level of economic viability that would ensure their long-term sustainability. The approaches followed by the public irrigation development and management agencies (known as "SAGI") responsible for these infrastructures are diverse. There is room for progress, which a subregional exchange of experiences could exploit.

Today, the confluence of traditional forms of irrigation and modern infrastructure and technology opens up a range of opportunities on which sustainable and economically competitive development programs can be built that would meet the growing demand of the markets. However, the development of irrigation in the Sahel suffers from a lack of continuity in efforts, insufficient capitalization and dissemination of successes, and a failure to take into account lessons drawn from failures. Effective, replicable methodologies and solutions are not often appropriated by actors and do not receive funding. At both the regional and national levels, sector strategies and policies provide guidelines in terms of the challenges and objectives the various programs implemented attempt to address more or less successfully but with a lack of overall vision for improving irrigation performance in the Sahel.

Consequently, only around 60% of the land area equipped for irrigation appears to be actually irrigated. It follows that the objective of the Dakar Declaration cannot be met merely by increasing developed areas but by combining the creation of new areas, the recultivation of existing areas, and increased crop intensity. It is essential that conditions for sustainable farming be taken into account in order to keep completed projects operational and avoid costly rehabilitations.

- *Irrigable Potential and Pace of Development*

Over the six Sahelian countries under consideration, the total land area irrigated from major rivers and their tributaries, according to water allocation models for cross-border watersheds, is currently 400,000 hectares under total water control and 800,000 hectares for all irrigation systems combined (including submerged areas). The various documents prepared on the scale of the major watersheds show that the area under total water control could be increased to more than 1.1 million hectares, 800,000 hectares irrigated in the rainy season and 300,000 hectares in the off-season. However, this would be limited to 800,000 hectares unless several large storage projects are completed in the Niger and Volta basins.

There is also widespread potential for mobilizing runoff water (in lowlands and hillside reservoirs) as well as groundwater. A major effort is needed to understand and monitor the resource at the local level and develop this potential as part of the integrated management of surface and groundwater resources.

To realize this potential, the six countries have investment portfolios covering around 340,000 hectares under small-scale irrigation and 180,000 hectares under large-scale irrigation, for a total of 520,000 hectares and a total investment estimated at US$ 4 billion. This program could make it possible to reach the objective of one million hectares. However, in terms of cost, the projects for which funding has been obtained represent only one-quarter of those surveyed, which shows the scale of the funding needs remaining to be covered.

An analysis of the pace at which developed areas are advancing shows that on average, approximately 40,000 hectares are coming under irrigation each year in the six countries. At this rate, it will take about fifteen years to reach one million hectares. Member States must therefore reinforce their investment portfolio for the development of private irrigation systems in order to achieve this objective sooner.

- *Implementation Approach*

The Strategic Framework rests on three pillars: diversity, integration, and commitment.

1. Diversity: From **Irrigation** to **Irrigations.** The Initiative supports the development of programs that take into account all types of irrigated systems in order to best respond to the needs of producers and to the opportunities presented by each region. Water efficiency

is optimized when it is supported by the diversity of compatible irrigation systems within a given region while taking into account the various uses in an integrated approach to managing the resource.

2. Integration: From **Land Development** to **Production System**. The Initiative supports taking into account production systems and their integration into networks so as to make development serve producers and not the other way around. For this purpose, irrigators need to be provided with a secure production environment that includes land rights, water rights, water service quality and predictability, sub-sector organization, and agricultural loans. Agricultural water management projects must be designed to evolve so that they can be adapted to producers' needs and to market dynamics.

3. Commitment: From **Concertation** to **Commitment by all Actors.** The Initiative calls on actors at all levels to commit to building shared solutions aimed at developing effective and viable irrigation. The active commitment of local communities and populations in the planning process must be ensured. To this end, modern knowledge management tools will be made available to actors.

The Strategic Framework makes use of the "**solution"** concept in putting performing irrigation systems in place for the long term. Solutions combine an institutional model, adapted infrastructures and technologies, a funding mechanism, and a training program for actors in order to meet the needs of a given type of irrigation system. They are implemented as part of a participatory and contractual approach ensuring responsible commitment by the parties along with methods for monitoring their compliance with their commitments.

The key characteristics of these solutions are as follows:

1. Sustainable irrigation management requires increased decentralization in order to put producers in a position of responsibility (through management transfer) while ensuring professional support from operators trained for that purpose.

2. Ensuring quality technical studies and works and making available more reliable equipment are conditions for permanent and well-maintained irrigation systems.

3. The problems associated with irrigated land and the methods designed to anticipate and manage these are well-known. Implementing these methods in the field on a large scale involves a vast lengthy, but unavoidable construction project. Successfully allocating land for new collective public projects is the first priority in this area.

4. Capacity building will improve the availability and quality of the necessary services offered for implementing the solutions identified. Ordering parties must ensure that so-called "soft" support activities are adequately taken into account.

5. Funding mechanisms must be adapted to each type of irrigated system while taking into account the various levels of borrowing requirements involved in development and systems operation plans. Contributions can be made to project funding by the beneficiaries, public operators, or private investors depending on the appropriate mechanisms. Mobilizing private funding starts with better recovery of operating and maintenance costs. Many types of financial instruments can be used and combined to promote private fundraising by means of proper structuring of agricultural financing and related sub-sectors.

- *Regional Dimension and Actor Commitment*

The similarity in issues and contexts among the various Sahelian countries argues for a pooling of the knowledge needed to formulate solutions for the regional plan. The six countries are therefore committed to adopting the Strategic Framework, collaborating in sharing experiences at the regional

level, ensuring the harmonization of projects structured by type of irrigated system, and utilizing joint services whenever economies of scale can be achieved. It is expected that this collective effort will broaden the measures taken by each country to a regional scale and considerably enhance the sector's visibility. This commitment is supported by CILSS in its role as coordinator tasked with ensuring regional consistency and the sharing of knowledge and experience. It also benefits from the regional political support of WAEMU and ECOWAS.

The proposed regional platform will have no impact unless it results in a genuine mobilization of national and local actors around the approaches proposed in the Strategic Framework. That is why a commitment is needed from all actors so that these approaches can be specified in the field as they continue to be enhanced through a recurring process of innovation, training, and monitoring and evaluation. Synergizing all actors is the only way to truly make a change and improve the performance of irrigation systems in the Sahel.

I. Vision for agricultural water control in the Sahel

Objective

The goal of the Sahel Irrigation Initiative is to contribute to the growth and resilience of the Sahelian region by improving the competitiveness of irrigated agriculture, and by increasing its added value in the agricultural development of the concerned countries, thereby contributing to job creation and to poverty reduction.

The initiative aims to support the States and actors involved in irrigated agriculture to increase areas under agricultural water control to one million hectares, while ensuring the viability, performance, and environmental sustainability of existing and future irrigated systems, and the associated agricultural development.

Vision

The vision underlying the Sahel Irrigation Initiative is the following:

> Diverse irrigation solutions adapted to the Sahelian context are established and funded within an enhanced institutional framework in order to make possible the development of irrigated agriculture that is sustainable, suited to the environment, competitive and inclusive.

Improving existing systems and supporting the numerous local irrigation development initiatives are accorded higher priority under the Initiative than the proactive spatial extension of these systems.

Implementation Approach

The implementation of this vision rests on three pillars:

1. From **Irrigation** to **Irrigations**:
   - Taking into account the diversity of investment opportunities in the field of agricultural water control.
   - Developing integrated solutions for the different types of irrigation systems including the revitalization and modernization of existing systems, as well as extensions and new developments.
   - Judiciously introducing these solutions into the territory by ensuring an integrated management of water resources, and the active involvement of communities and local populations in the planning process.
2. From **Development** to **Production System**:
   - Integrating irrigations into production systems, while taking into account the complexity of the latter. Place the producer at the heart of the approach.
   - Secure the irrigators' productive environment: land and water rights, water service quality and predictability, sub-sector organization, and agricultural loans.
   - Designing hydro-agricultural developments that can evolve so as to respond to the dynamics of the markets.
3. From **Concertation** to **Commitment** by all actors:
   - Ensuring active commitment by actors at all levels to building shared solutions aimed at developing effective and viable irrigation.
   - Making available to actors modern knowledge management tools.

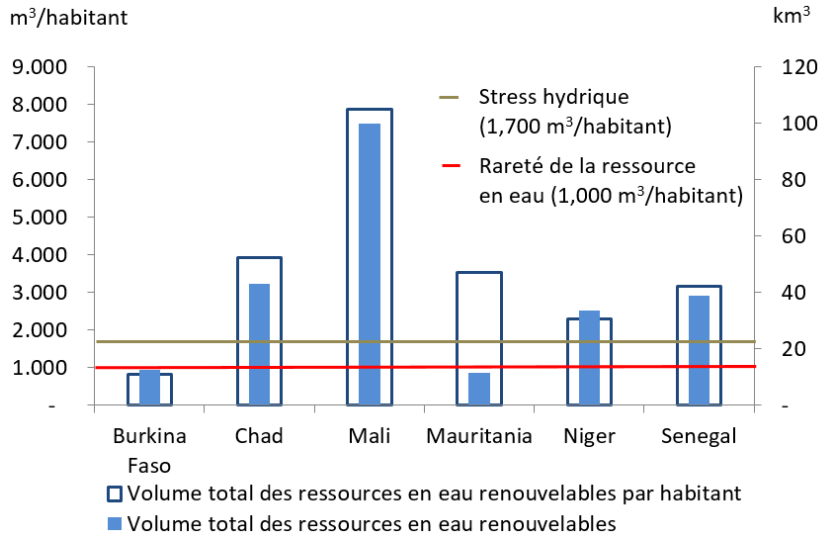
II. Sahel, Water and History: a key focus for understanding and envisioning the future of Sahelian territories

Where do we come from? A historical perspective on irrigation in the Sahel

A fundamental constraint to agricultural development: climate variability

The Sahel, although generally described as an "arid and semi-arid zone", is a very vast and diversified area. It is characterized by considerable rainfall variability between the arid part in the north, which has an average annual precipitation of 200 mm, and the Sudano-Sahelian part in the south where the annual rainfall exceeds 600 mm. The African monsoon and its associated large watersheds are abundant resources, which are however unevenly distributed in time and space (long dry season and risks of drought). Overall, and with the notable exception of Burkina Faso, Sahelian countries are well above water stress and scarcity thresholds (Figure 1). This relative abundance is related to the flow of large rivers originating in wetter areas. Burkina Faso, located in the Volta Basin head area, does not benefit from such transfer.

Figure 1. Total renewable water resources per capita



Source : http://chartsbin.com/view/1470)

The year-to-year rainfall variability has a great impact on agricultural production, with a cereal production level correlated directly with the amount of precipitation. Yields also depend on the regularity of rains during the season: a dry spell (lack of rain) occurring at crucial vegetative growth stages can severely damage crops.

Traditional forms of water control that are suited to the environment

In the Sahel, adaptive agricultural practices, which minimize natural risks such as droughts or dry spells during the rainy season, are very widespread. These are generally extensive practices (scattered fields, low tillage, extended sowing period, varietal diversity, transhumant pastoralism, multiple jobholding, etc.) that are possible in a context of low population density. They are strongly constrained by the labor force available in rural households, resulting in a marked sexual division of labor. However, the available labor varies between the Sahelian zone in the north, and the Sudanian zone in the south, resulting in a distribution of activities between livestock and crop production, and in a differentiated social and family organization depending on the production system.

The troubles and constraints that have punctuated the history of the Sahel (trafficking, wars, depopulation, colonization, postcolonial statism, etc.) have been a stumbling block or have contributed to the decline of adaptive practices based on farmers' knowledge. These practices have become less common or have even disappeared, thus impeding endogenous water development. The productivity of flood-recession and rainfed agriculture associated with livestock production in a context of low population density has left the practices unchanged, as it was largely sufficient for subsistence and the accumulation of rural capital (granaries, livestock) with sometimes brutal crises arising from rainfall variability.

In this context, space occupation by Sahelian agriculture, which is essentially rainfed, is based on the run-on resulting from slight topographic variations over distances ranging from a few dozen meters to several kilometers in some cases: Tiger bush, lowlands, flood-recession areas (river banks and wallo). In the rainy season, the Sahel is a world of ponds and detention basins where the microtopography, land forms, inter-dunal depressions, endorheism and disorganized drainage basins are exploited by Sahelian farmers. Natural floodplains are sometimes supplemented by "fuse" earth dams, as in Mauritania. This helps to understand the importance of livestock farming which efficiently utilizes the biomass in these areas, including in the dry season. Owing to rainfall variability, producers, including those who are settled, become highly mobile in order to find the best territories for livestock and crop production.

The Sahel, however, is not condemned to risky rainfed agriculture: even if African irrigation exists in non-Sahelian mountain areas, lowlands and flood/flood-recession cropping systems on the banks of major rivers but also *spate irrigation* with flood control reservoirs on intermittent streams help to limit risks and diversify crops. On major rivers, flood crops (floating rice, bourgou[1] , etc.) and especially flood-recession crops (sorghum, maize, squash, beans, etc.) are an important part of the production system. The Lake Chad area is a breadbasket for the Central Sahel[2] with its wet soils extensively and diversely cultivated without any developments. In the absence of irrigation or with small-scale supplemental irrigation, the Lake's lands are preferred to those of the Logone-Chari valleys. This is the case for small rice polders in the Bol region in the north-east of Lake Chad, or other indigenous innovations.

All these forms of basic water control have existed in ancient and recent African civilizations throughout history. However, none of these rural African societies are considered "hydraulic societies"[3] benefiting from a tradition of collective water management. Difficulties in irrigation in the Sahel, for example on the Logone and Chari rivers, can be explained by the absence of a baseline of farmer practices on small-scale endogenous developments. Thus, the exogenous rice cultivation projects of the Rice Production Development and Modernization Company (SEMRY) have been converted into multi-purpose projects owing to the difficulties encountered: the Waza Logone social organization did not comply with the irrigation management requirements of the State and donors. The same often applies to the rest of West Africa.

However, these forms of partial water control are increasingly vulnerable following the regulation of rivers by large dams, even though they had the highest labor productivity (low tillage and no weeding) compared with rainfed or irrigated crops.

[1] Echinochloa stagnina, a highly appreciated forage plant
[2] Magrin G., Lemoalle J., 2015. Le développement du lac Tchad. IRD-CBLT.
[3] as defined by K. A. Wittfogel.

Box 1. Small rice polders in the Bol region in the north-east of Lake Chad

Historically, polders were designed by constructing dikes that held back Lake Chad floodwaters, enabling farmers to practice flood recession irrigation. The gradual drying up of the lake since the 1970s, especially the northern basin, has revealed many depressions between the dunes that have been transformed into new polders by farmers. They have been able to quickly adapt to the new hydrological conditions of the lake by exploiting water from the water table which, because of its very shallow depth, is easily mobilized for irrigation. When there is abundant rainfall, which is increasingly rare, the polders' edges are cultivated first, and as the water recedes in the polder the downstream parts are also cultivated.

Polders provide significant agricultural production gains through increased harvests (up to 3 for some crops). Despite the drying up of Lake Chad, the Bol region is still considered an agricultural breadbasket. Agricultural products are intended for both local consumption and for export for the most profitable. However, the area faces the risk of salinization of polder soils in the absence of flooding by lake waters that allow leaching. To mitigate this salinization process, farmers need to design or improve their drainage systems.

Sources: FAO (The future is an ancient lake - Traditional knowledge, biodiversity and genetic resources for food and agriculture in Lake Chad Basin ecosystems) and IRD (December 2011 scientific news sheets).

Historical liabilities: large investments made in the 1970s and 1980s with low profitability and substantial negative impacts

The sub-Saharan region and the Sahel in particular, experienced a phase of significant investment for the development of hydro-agricultural projects in the 1970s and 1980s. These were mainly integrated projects aimed at developing crops such as rice, under the responsibility of national development agencies with a mandate ranging from infrastructure building to the marketing of agricultural products.

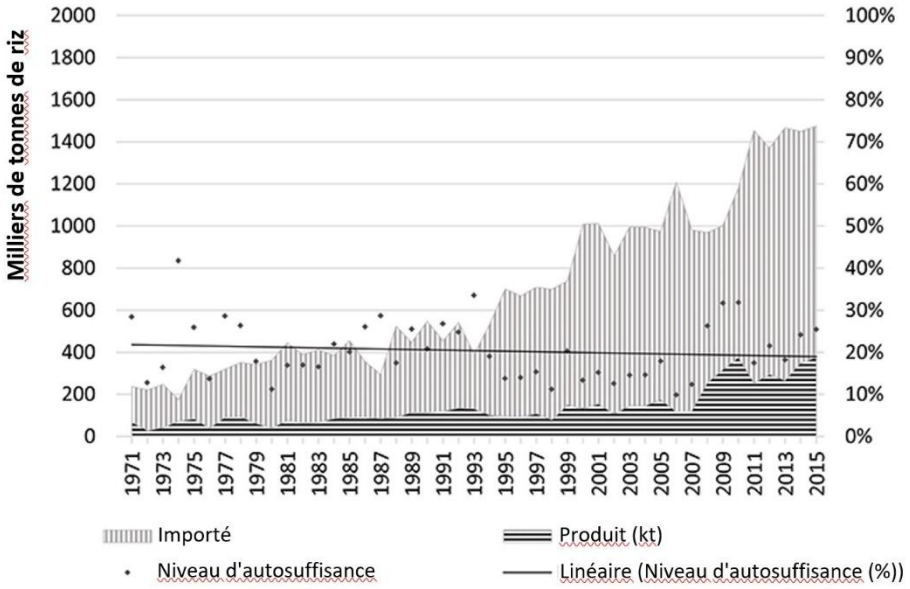
This period was characterized by the "proclaimed" development of the irrigable potential according to standards established by engineers, resulting from a centralized "*top down*" approach, with the omnipresence of the government, often leading to the exclusion of other water and land uses, particularly fishing and livestock production[4]. This eventually translated into an over-specialization of the environment, with major ecological and social impacts such as waterborne diseases, soil depletion or salinization, etc. Several *ex-post* studies have shown that the economic viability of these large-scale projects was uncertain if the cost of environmental impacts is taken into account. Moreover, as a rule the government continues to subsidize their operation and, often, to finance their rehabilitation.

These projects have contributed in different ways to the reduction of the rice production deficit in Sahelian countries. The case of Senegal (see Figure 2) shows the size of the growing rice deficit, between production and imports. Despite massive investment in irrigation development, the rice self-sufficiency rate remains around 20% with a slight downward trend. The most significant production growth occurred after the 2008 global food crisis, a period corresponding to a sharp rise in producer prices, without a concurrent increase in the areas under irrigation. This high elasticity of

[4] Manikowski S., Strapasson A., 2016. Sustainability Assessment of Large Irrigation Dams in Senegal : A Cost-Benefit Analysis for the Senegal River Valley, Front. Environ. Sci., 17 March 2016 http://journal.frontiersin.org/article/10.3389/fenvs.2016.00018/full

production in relation to market demand raises questions as to the effectiveness of the policy of major hydro-agricultural developments: wouldn't protecting the market be sufficient to achieve the same production increases as those resulting from greater availability of irrigated areas?

Figure 2. Rice production growth in Senegal and imports between 1970 and 2015



Source: International Rice Research Institute – International Rice Research Institute (2015), using USDA database

More generally, there is a production growth in several strategic sectors, especially the cereal sector in the West African region[5]. Cereal production increased by 59% between 2000 and 2012. The highest increases include rice (+95%) and maize (+130%), which were the main irrigated cereals during that period. Unlike the other cereals, these increases were mainly attributable to higher yields[6]. Even if the results are not specific to the Sahel and irrigated crops, these estimates show the strategic importance of the irrigation potential in the Sahel, despite a relative "return of the rains" since the end of the major droughts.

But, usually in the Sahel, increased food demand is met primarily through spatial expansion of crop areas under rainfed agriculture to the detriment of livestock production, fallow lands, and the natural environment, causing tensions over land due to space saturation. This is mainly due to low agricultural productivity growth in rainfed systems. That is how, for some regions, with a form of local consensus, family irrigations in Office du Niger in Mali (Segou Foresight Workshop in 2015) can be positively repositioned as a significant potential response to the food supply/demand issue. In the case of Office du Niger in Mali, paddy yields have improved considerably since the 1980-1990 rehabilitations, and the abandonment of state control over paddy processing and marketing, resulting in the beginning of double cropping of rice, and a high diversification (maize, market gardening, fodder crops, etc.) in the dry season.

The policy of major developments, even if it has not achieved all the expected results, remains a key component of actions in the field of food security, and a historical centerpiece for some regions (Senegal River Delta, Office du Niger area). Irrigation, even if it is not a systematic or unequivocal response to aridity or climate variability, is fully justified in the light of the numerous other issues

[5] *What is the assessment of West Africa's agricultural policy ten years after its adoption?* http://inter-reseaux.org/IMG/pdf/bds19_ecowap_mars2016.pdf

[6] Between 2000 and 2010, the 71% increase in paddy rice production may be explained by higher yields (annual growth of 2.9% over this period).

(jobs, poverty, economic growth, productivity, trade balance, etc.). But the productivity of agricultural work in irrigated systems remains often constrained by excess water (insufficient drainage), the lack of servicing and maintenance of the hydraulic network, weediness and low water availability of canals, and the reduction in the size of land plots accessible to the growing number of households. Irrigation will be all the more justified if it responds to the needs for diversifying production and promoting agricultural work by taking into account the various socio-technical forms of water control available to the great diversity of rural societies.

Opportunities: an "endemic" practice of agricultural water control, and many innovative experiences and recent successes on which to base sustainable and economically competitive development.

Methods of water control suited to the environment existed before the colonial era and permitted a harmonious and profitable exploitation of the territory's potentials. For example, flood-recession agriculture, whose scope has been reduced as a result of the construction of major regulation works on the main rivers remains, even today, the preferred method in comparison with total water control by operators when it comes to allocating their production means. In rainfed areas, local farmer practices such as zaï, half-moons, or stony cords have been placed at the forefront by NGOs following the long droughts in the Sahel during the 1970-1980s, often in the framework of social "food for work" projects. [7]

In addition, there are many cases of spontaneous development of small-scale irrigation in the dry season, sometimes in adverse conditions requiring a lot of work: the Dogon shallot in Mali, the Galmi purple onion in Niger. This form of intensification of market gardening is related to the growing population density, and also to the search for rewarding economic niches in the absence of alternative choices. In some cases, crop diversification through rapid and localized appropriation of pumped irrigation (For example, Podor-Matam or Niger River loop VIS) benefited from the strong social structuring of the local population (Haalpulaaren and Songhay). There is also a dynamics of small-scale irrigation linked to the private sector's demand for highly diversified vegetable or fruit products. Dried Moringa Oleifera leaves, a rich food condiment from Goulbi in Niger, are an example of a dynamic sub-sector.

Today, the confluence of traditional forms of irrigation and modern technologies opens up a range of opportunities on which sustainable and economically competitive development programs can be built. These opportunities are increased by the fast-growing demand for agricultural products owing to population growth and its accompanying rapid urbanization.

Finally, there is at the same time an interest from private investors seeking opportunities in large irrigated areas, particularly in the Senegal River Delta and the Office du Niger area in Mali, sometimes with support from state-funded projects[8]. Concrete achievements remain anecdotal and generally limited in scope but nevertheless constitute "anchor points" around which less public resource-intensive development can be organized. However, there is need to ensure that these investments are integrated into local contexts and to avoid creating imbalances or exclusions in terms of access to natural resources such as water and land.

[7] The zaï is a farmer technique that consists in creating a basin on indurated soil for use as a mini water reservoir (impluvium) in case of insufficient rain, in which organic matter is placed and worked by the soil's microfauna and termites creating porosity and a capacity for infiltration. Sowing is made within the basin.

[8] PDIDAS in Senegal, BagrépÔle in Burkina Faso.

⇒ **A renewed dynamic: slower development since the 1990s, but a strong demand, from both the private sector and family farming.**

⇒ **Competitive development opportunities based on a combination of endogenous practices and recent innovations.**

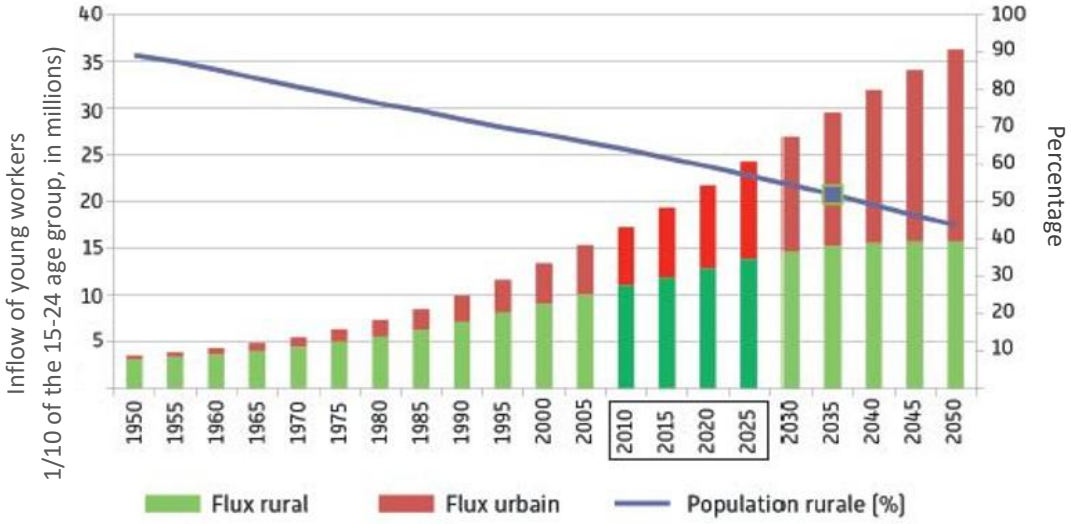
Where are we going? The strategic place of irrigation in the Sahel: issues, food security and employment

A series of crucial issues call for the revitalization of all forms of water control including irrigation. The rapid growth of the Sahelian population resulting from an uncompleted demographic transition, its rapid urbanization, and the need for jobs for rural and urban youth entering the labor market (Figure 3) call for massive productive investments. The fight against insecurity and socio-political unrest in Sahelian regions requires the creation of jobs for rural and peri-urban youth. To meet these challenges, the definition and coordination of public policies is essential, primarily those on agriculture, food and rural development. Among the technical and economic responses aimed at reducing the level of poverty, irrigation is often mentioned as an opportunity.

Historically, the place of irrigation and other forms of water control is the result of institutional cycles that shape agricultural and food policies. There is a pendulum effect between the three (historical, cyclical and ethical) purposes of food policies depending on the period:

- The historical objective of food self-sufficiency is often favored by the States because of their trade imbalance and the political positioning of necessary food independence.
- The food security orientation, which is an objective with a more cyclical justification, has often been considered to withstand climatic or market shocks, in order to avoid soaring prices and urban riots, and this, by means of more or less reasoned imports in conjunction with the development of local production.
- Finally, since the 2000s, the option of food sovereignty has been asserted under the pressure of public debate to ensure sovereign, but also qualitative and diversified food choices, in the face of a pressing social demand, even if in the Sahel, basic food demand (calories) remains a priority.

Figure 3. Comparative evolution of rural and urban jobseekers and forecasts for 2050 in Sub-Saharan Africa.



Sources: United Nations, World Urbanization Prospects, 2011 revision, and World Population Prospects, 2010 revision; Losch, Fréguin-Gresh, White (2012)

Strategic choices are based on national and often old priorities that have been reiterated (irrigated rice and sugar). There is need to build on the assessment of these, while considering trends on the ground including farmers' numerous initiatives to diversify production, the growing share of investors in export agribusiness, but also the abandonment of risky, premature or unsustainable projects or investments, due to marked social or land-related tensions (for example the Senhuile project in Senegal which has been in the news in 2011 and again in 2016 following the violent opposition of the local population[9]).

The various forms of irrigation can make notable contributions, in terms of added value, jobs created and environmental management, to achieving the combined goals of food policies. In fact, when Sahelian farmers already practice spontaneous irrigation, the implementation of an irrigation program is facilitated.

Women are often on the front line of irrigated production in the Sahel. Irrigation provides them with an additional source of income adapted to their needs, provided they are involved in land development decision-making and in resource (especially land) allocation processes. Situations where women are excluded from land development operations are all-too frequent.

⇒ **The development of irrigation should enable local products to regain market share while maximizing the added value of irrigated products for job creation. The gender issue must be taken into account to ensure women's participation.**

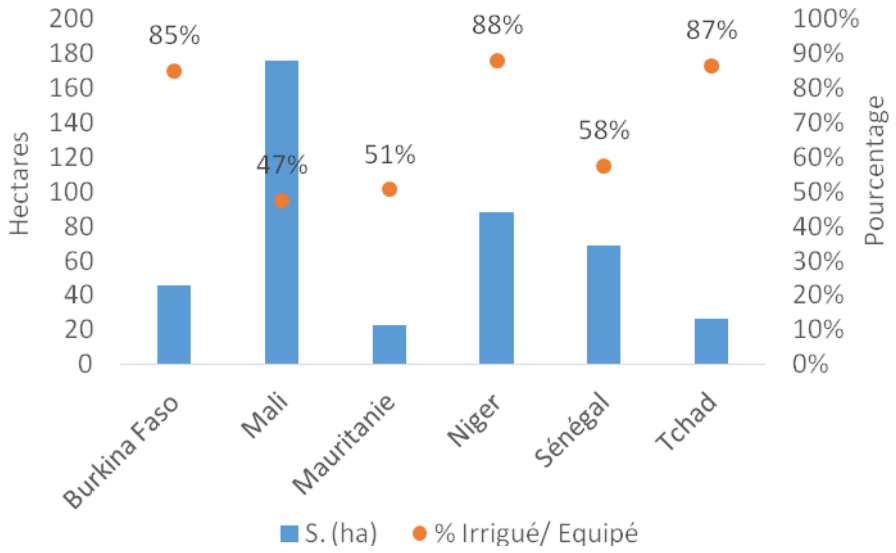
In so doing, it is necessary to anticipate factors blocking the dynamics of farmer irrigation. These may be hydrological and hydraulic bottlenecks that can be removed through structural developments and water saving as well as the establishment of water governance at the appropriate level, allowing the resolution of conflicts over access to the resource. Land and social obstacles can be anticipated through local negotiation frameworks such as land committees and through the implementation of adapted methodological tools (for example: Land Use and Development Plans - POAS in Senegal).

[9] See for example: https://www.oaklandinstitute.org/blog/community-resistance-senhuile-land-grab-sparks-hope-senegal

Finally, technological and financial bottlenecks can be addressed by supporting the development of irrigator services (service delivery, such as pump repair, sub-sector support, microfinance, etc.) or growth poles (such as Bagrepole in Burkina Faso).

These various bottlenecks and their corresponding responses can be more easily addressed when irrigation is integrated into the specific dynamics of production systems in relation to their natural environment. An appropriate strategy must anticipate and consider moving towards water demand management in response to natural shocks and climate change, to go beyond the traditional supply management (dams and inter-basin transfers) or the probable saturation of water resources (groundwater and low water flow) in high-demand areas. This change would aim to enhance the performance of new developments and particularly to increase the rate of development, i.e. the proportion of cultivated areas compared to developed areas.

Figure 4. Developed and cultivated areas (by country)



Source: FAO/AQUASTAT
Note: according to a more recent inventory developed areas in Chad cover 43,000 ha

Chapter IV, dedicated to solutions, lists the conditions for success in the light of national experiences. These conditions vary in nature: technical, social, institutional, economical and infrastructural. It is by appropriately combining and adapting these parameters to each zone and type of irrigated system that significant progress can be envisaged. Social considerations must necessarily take into account the gender issue in order to provide women with opportunities to secure and diversify their income adapted to their needs.

⇒ **The irrigation development strategy must anticipate bottlenecks by taking into account the historical experience and thus go beyond the usual supply management.**

III. Shared water resources: irrigations in the Sahel

Irrigation that works: a variety of irrigation methods

There is a wide range of hydro-agricultural developments including lowland development, large-scale public and private schemes, small-scale individual irrigation and village irrigation. This diversity is a regional asset that should be preserved and used to develop Sahelian solutions to agricultural water control.

Table 1. Different types of irrigation

Type of water control system	Examples of successful experiences
Type 1: Lowland development and controlled submersion	Lowlands: Burkina Faso Controlled submersion: Lake Chad area
Type 2: Small-scale private irrigation	Niger PIP2 project, Mauritania VISA project
Type 3: Community Irrigation	Mali IPRODI project
Type 4: Large-scale public irrigation	Senegal SAED, Boundoum scheme
Type 5: Commercial PPP Irrigation	Current experiences in Burkina Faso (BagrePole project) and in Senegal (PDIDAS project)

Source: Work of the Task Force, 2015

These systems, however, are not independent elements; they can be developed jointly in a given territory so as to make the most of the opportunities offered by this territory. For example, developed lowlands help to better secure the main production in the rainy season. They also improve groundwater recharge and thus develop individual small-scale irrigation which is highly profitable in the dry season.

Small-scale irrigation solutions (types 1 to 3) can be scaled up by increasing the number of schemes and generating very significant economic benefits. In Niger, the World Bank-financed PIP2 project supported the modernization and development of 16,000 ha under private small-scale irrigation (type 2), in connection with groundwater recharge developments (type 1), with an internal rate of return of 27%.

There are also small-scale private or collective irrigation solutions (type 2 or 3) that can be developed within large-scale public schemes (type 4). The objective is to improve water resource development through the joint use of surface water brought by channels and groundwater mobilized through shallow boreholes recharged via surplus water from surface irrigation. This beginning of reuse of irrigation water, which is a driver of crop intensification and diversification, can be observed in the dry season in schemes such as Office du Niger in Mali. It may experience difficulties in collective irrigation management and other water management problems such as waterlogging due to lack of drainage. This highlights the importance of finding institutional solutions for joint management of surface water, groundwater and drainage water resources.

Positive experiences exist for all these systems, and some are mentioned in the solution tables by type of irrigated system in chapter IV. However, they are not or rarely generalized. With this Strategic Framework, the Sahel Irrigation Initiative's primary objective is to level upwards the performance of the various irrigated systems. It also seeks to better adjust investment choices by taking into account the possibilities of combining the systems, in order to optimize the development of natural and human resources, and to maximize the return on investment for both the State and the private sector (producers and sectors' stakeholders).

The diversity of irrigations is consistent with the diversity of territories. It is linked to the multiple

uses of water and takes into account the limits of the resource which is often available, hence the need for an in-depth inventory. The terms of the water-sharing will be gradually clarified through participatory planning tools, involving irrigator communities, local authorities, land development companies, research institutions and experts. Thus, based on the identification of local, often spontaneous or non-governmental small-scale community or individual irrigation initiatives, and the potential in terms of land, water, labor, social structures, at an appropriate level (watershed, production or employment area, urban periphery for market gardening), a program of support to the development of water control actions can be launched.

⇒ **The Initiative supports the development of programs that promote successful experiences and take into account all types of irrigated systems in order to best respond to producers' needs and to the opportunities presented by the regions.**

Irrigation Development and Management Agencies: a key role to consolidate in a tripartite relationship with the State and irrigators

Since the 1970s[10], the Sahelian states have created public institutions[11] collectively referred to as *Irrigation Development and Management Agencies (SAGI)* to develop vast collective irrigation areas along major rivers or near large dams, but without giving them a country-wide mandate. The objective was to resolutely mobilize water for the development of rural areas with a view to achieving rice self-sufficiency. These agencies have played a key role in building water mobilization and distribution infrastructures in their capacity as State-Delegated Project Manager (MOD) and sometimes as a public works company.

In the first few decades, they fulfilled most of the functions that make irrigated production possible, including input supply, marketing, maintenance and sometimes post-harvest processing. Until the 1990s, farmers were mostly the implementers of an administrated irrigated agriculture. During the 1990s, the public debt crisis that affected the countries resulted in a significant decrease in public resources allocated to SAGIs, thus limiting their effective capacity for action, and a reduction of the range of their missions, sometimes planned but most often without an explicit exit strategy. The consequences of this transition are felt until today on the nature and the quality of the relations between the State, SAGIs and producer organizations and thus on the degree of mutual accountability.

Most of the SAGIs have withdrawn from the production functions to focus on water management and infrastructure maintenance, depending on the case, as technical operator (large complex network of Office du Niger in Mali) or prescriber and auditor when water management is the responsibility of irrigators, following the de facto withdrawal of the state or a formalized management transfer process (medium sized schemes - a few hundred hectares). Agricultural advisory support to irrigators remains present for many of the SAGIs. Some of them, such as SAED, have developed extended expertise in spatial planning and knowledge for the benefit of all. Sometimes they play a role in land management. The changes observed most of the time are a refocusing on public service missions and on strategic support for the management of existing developments by irrigators.

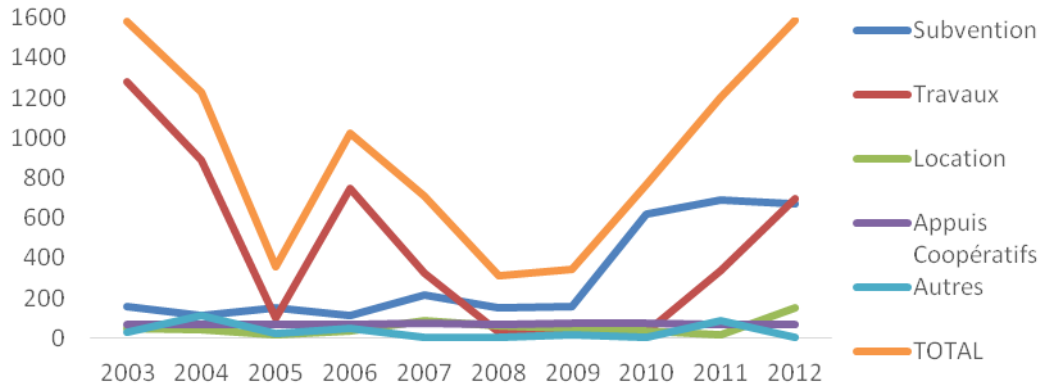
A major challenge faced by SAGIs is to maintain in good condition publicly funded irrigated systems. The fees paid by irrigators cover only a portion of the operating and maintenance costs of the irrigation and drainage systems. These costs are frequently undervalued and rarely readjusted. The transfer of the infrastructure to irrigators (Agricultural Water User Organizations, EIGs or

[10] Back in the 1930s for Office du Niger in Mali and more recently (1990s) for the Bagré scheme in Burkina Faso.
[11] Public Administrative Establishment or Public Industrial and Commercial Establishment.

Cooperatives) mitigates this problem but does not solve it completely. In fact, SAGIs often face a dilemma: replace irrigators when they do not provide maintenance - at the expense of their empowerment - or not to act - at the expense of the sustainability of the schemes.

As a result, despite revenues generated by irrigation fees, SAGIs remain partly dependent on State funding. This funding often varies or comes late, which compromises the implementation of the tasks entrusted to SAGIs (see Figure 5). Multiannual contracts (performance contract and assignment letter) offered by several States ring-fence resources for SAGIs to achieve quantified negotiated objectives. Several of these framework documents are tripartite, with, in addition to the State and SAGI, irrigators' representatives. Experience shows that this strengthens the parties' accountability.

Figure 5. Evolution of ONAHA's financial resources in Niger 2003-2012 (Million CFA)



Source: ONAHA data (Niger)

The processes of transferring management to irrigators have reached very different stages from one SAGI to another, with varying results. A *benchmarking (comparative analysis of performance or operation) approach* and exchanges between irrigators can help to identify and overcome obstacles and move forward in the establishment of balanced partnerships between SAGIs and OUEAs.

⇒ **Given the history and local context, the SAGIs' trajectories and circumstances are diverse. There is still room for improvement which a sub-regional exchange of experience could help to achieve.**

⇒ **Ensuring clarity and complementarity of functions (State, SAGIs and Irrigators), enhancing actors' capacity to effectively perform these functions within a contractual framework and with adequate resources are the pillars of the performance of irrigation in the SAGIs' intervention areas.**

Table 2. Focus on some SAGIs

	MALI	SENEGAL (River Valley)	SENEGAL (Casamance)	MAURITANIA	NIGER	BURKINA FASO
	Office du Niger	SAED	SODAGRI	SONADER	ONAHA	BAGRÉPÔLE
Legal status	EPIC since 1989 (supervised by the Ministry of Agriculture)	State Company (supervised by the Ministry of Agriculture)	PLC - the State is the majority shareholder (supervised by the Ministry of Agriculture)	EPIC (supervised by the Ministry of Agriculture)	EPIC (supervised by the Ministry of Agriculture)	Semi-public company since 2012 *(Supervised by the Prime Minister's office)*
Date of establishment	1932	1965	1974	1975	1978 - reform in 2014	2012
Typology of irrigation schemes	Large-scale schemes (smallholders) + Agribusiness	Large-scale schemes (smallholders) Village schemes (smallholders)	Large-scale schemes (smallholders) Private schemes	Large-scale schemes (smallholders) Village schemes	Large-scale schemes (smallholders)	Large schemes (smallholders) Agribusiness
Equipped area under mandate	127,000 ha	1,250,009 ha	5,000 ha	25,500 ha	15,226 ha	3,900 ha
Irrigated area / year (2014)	110,500 ha	78,000 ha	3,000 ha	18,800 ha	2 X 10,000 ha (double cropping)	3,400 ha
Contractually defined missions with the State	Management Decree **Contract Plan**	Concession Contract ***Assignment Letter***	Statutes **Assignment Letter**	Statutes **Performance Contract**	Order + Decree Contract Plan in preparation	Decrees Strategic Plan
Operators	Family Agricultural Enterprise Agro-investors	Family Agricultural Enterprise Agro-investors	Family Agricultural Enterprise	Family	Family	Family Agro-investors
Producer Organizations	Joint Committees Tertiary network maintenance organization	Hydraulic Unions (HUs), GIE-SV	HUs, Individual Cooperatives, private companies	Cooperatives Cooperatives Unions	Rice cooperatives - Cooperatives Unions	Beneficiary groups
Mode of management of hydro-agricultural schemes	Joint management - defined responsibilities and roles: structures and main channels (SAGI), and tertiary channels (OERT)	Almost complete transfer including large schemes: management by autonomous and organized irrigator associations	SODAGRI is responsible for infrastructure management but this contrasts with practice	Missions and functions largely undetermined	De facto transfer of responsibilities to cooperatives to be ratified and consolidated, in order to clarify roles	SAGI is responsible for infrastructure management POs not playing a leading role
SAGI – Operator "contract"	Specifications	Irrigated Land Charter (Charte du domaine irrigué)	Irrigated Land Charter (Charte du domaine irrigué)		ONAHA-Coop, Coop-Operator Contracts	Terms of reference
Operators' obligations	Maintenance of the hydraulic network and payment of fees	Development and payment of fees	Development	Development	Payment of fees and development (ongoing evolution)	Farmer/Private: development Farmer: join a farmer organization, and payment

						of fees and taxes

Water in the Sahel: a resource to share equitably at different levels of scale: watersheds, irrigated systems, subsections of irrigation schemes (mailles hydrauliques) and plots

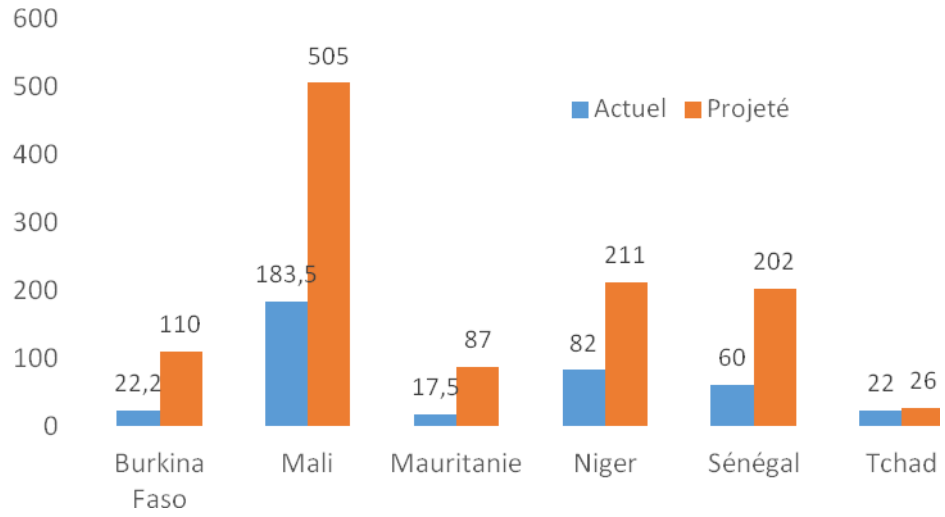
Irrigation is, primarily, about sharing water socially before distributing it physically. It is a contract between public authorities responsible for managing the resource and individual or collective users, and among users themselves within the same system.

Potential for development along the major watercourses

In the Sahel, water is first and foremost an internationally shared resource. The map below shows the four major basins and the corresponding main rivers that structure the western Sahelian belt and represent the key areas of development of public and community irrigation. The region has relatively old and active cross-border basin organizations, most of which have prepared concerted development plans among riparian countries and users' charters to guide planners in each State. These documents make it possible to determine the potential that can be developed along major watercourses as well as its distribution by country, taking into account the various sectors' needs and the allocation rules defined within each basin. The potential is, of course, dependent on the existence or the planned implementation of large storage structures on the main watercourses.

For the six Sahelian countries, the total land area irrigated from major rivers and their tributaries is currently 400,000 hectares under total water control and 800,000 hectares for all irrigation systems combined (including submerged areas). As shown in the table below, the various documents developed at the watershed level show that this area could be increased to more than 1.1 million ha, of which 800,000 ha would be irrigated in the rainy season and 300,000 ha in the off-season. The associated water requirements would then be 10 billion cubic meters in the rainy season and 9 billion in the off-season for perennial crops (mainly sugar cane). It should be noted that the irrigated areas of the Senegal River Basin could be increased, without new dams or control structures, and reach 300,000 ha by 2025; 150,000 ha could also be irrigated in the long term in the Lake Chad Basin, mainly in Niger.

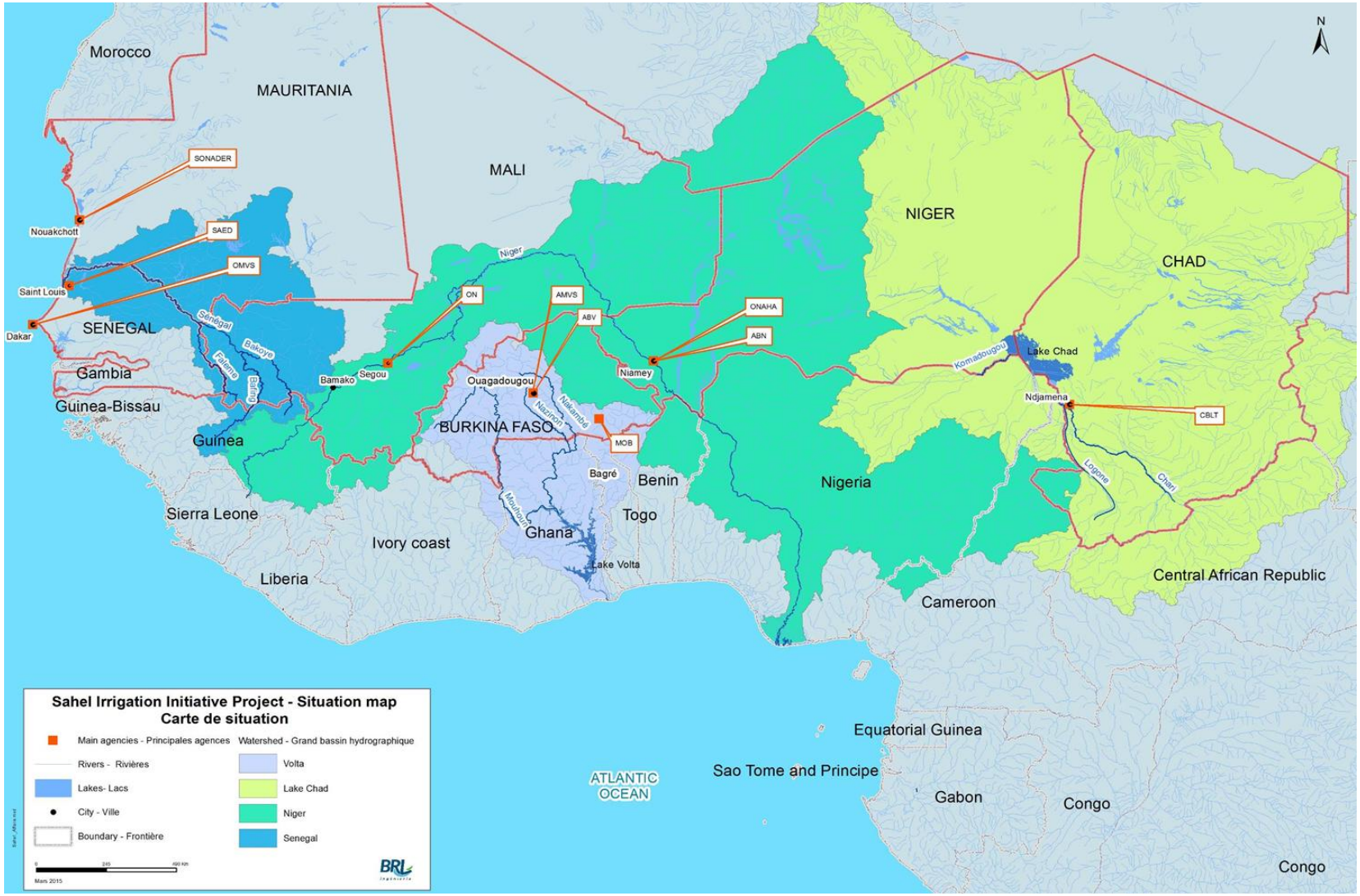
Figure 6. Current and projected situation of irrigated areas by country in relation to available water resources of large basins (x 1,000 ha)



Source: The Task Force's Water Resource Thematic Report, BRLi 2015

Note: according to a more recent inventory, developed areas in Chad cover 43,000 ha with a potential of 57,000 ha

Map of the Sahel's major watersheds



Source: The Task Force's Water Resources Thematic Report, BRLi 2015

For the Niger basin, the development of irrigation is still possible in the rainy season, but in the off-season, it requires the construction of regulatory structures. In case only the Kandadji dam, currently under construction, is developed, the irrigable area in the basin would be 400,000 ha (compared with 230,000 ha irrigated today). It could reach 600,000 irrigable ha with the construction of the other dams at the project stage (Fomi and Taoussa). However, the security situation in northern Mali compromises the progress of the Taoussa project and the Fomi dam forms the subject of further economic, social and environmental studies.

In the Volta Basin, and more particularly in Burkina Faso, almost all the resources are already used in very dry years and there is hardly any volume available for developing new irrigated areas. Regulatory structures are therefore needed to develop irrigation. In case all the planned structures are not built in Burkina Faso, the maximum developed area along the main arteries would remain close to the current situation (20,000 ha) against 120,000 ha planned with the various control structures.

Table 3. Potential for increase in irrigated areas per basin of abstraction taking into account the new dams (under total control, in the rainy season and the off-season, x1, 000 ha)

Basin	Current	Projection	Large dams planned	Without new dams
Niger	229	596	Kandadji alone brings the potential to 400, Fomi and Taoussa help to reach 600	Kandadji alone brings the potential to 400
Volta	22.2	110	Several new structures	remains at 22.2
Senegal	79	305	-	-
Chad	57	146	-	-
Total	387.2	1157		873.2

Source: The Task Force's Water Resource Thematic Report, BRLi 2015

Diffuse development potential

In addition to the irrigable areas along the main watercourses, the Sahel region has a largely untapped potential for local rainwater mobilization: the development of lowlands thus results in improved water control in the rainy season; ponds, hillside reservoirs, underground water resources provide supplementary irrigation in addition to rainfall but also dry season irrigation. This potential is probably underestimated in the commonly used figures. The recent Drylands study[12] announces an irrigable potential of 322,000 ha in Burkina Faso, mainly in peripheral areas, compared to some 110,000 irrigable ha along the above-indicated major watercourses.

Hillside reservoirs are storage structures with a retention capacity of less than 1 million m^3. Although individually small, these structures are numerous and scattered in the various countries and thus contribute significantly to curbing rural exodus. There are 1,200 such structures in Burkina Faso. In this country, the area irrigated in 2013 from hillside reservoirs was estimated at 20,000 ha[13]

The potential for groundwater use is also high, although extremely diversified. Its mobilization for irrigation is faced with profitability challenges, given the low water availability of boreholes and the cost of energy. In favorable areas, there is a great potential for very small catchments in areas of interdunal depression or basins or even where the water table outcrops, using low-cost drilling

[12] Confronting drought in Africa's Drylands : Opportunities for Enhancing Resilience, R. Cervigni and M. Morris, Editors, World Bank 2016

[13] with an average of 16 ha per reservoir, which is low compared to the cost of the reservoir.

techniques already widely disseminated in some countries (Niger in particular, but also Nigeria, Burkina Faso, etc.).

Box 2. The use of groundwater

The use of Groundwater (GW) represents low volumes and small areas compared to surface water, i.e. about 65,700 ha across the 6 countries and 15% of irrigated areas, with a wide variety of situations depending on the country. The use of GW is unprofitable under large-scale irrigation and mainly concerns small-scale irrigation and micro-irrigation from shallow resources and with manual or low-cost dewatering methods (motor pumps) by small farms with areas ranging from some acres to a few hectares, which mainly cultivate crops with high added value (market gardening and tree cultivation). Small-scale irrigation using GW is, however, of major socio-economic importance in the six countries, given its contribution in terms of food security, employment and added value. The degree of pressure on GW resources varies greatly from one country to another but also within a country. Most of the irrigation from GW takes place in large valleys on alluvial aquifers, oasis basins and depressions, or productive, shallow aquifers. The use of GW is proportional to the aridity of the locality with regard to total irrigation (north-central Mauritania and Chad). Representing 2 to 40% of the water used in irrigation depending on the country, GW still offers a great potential for exploitation within the limits of the local hydrogeological potentialities which are sometimes significant.

Harnessing the diffuse potential for water resource development, and particularly underground resources, is not without risk: cases of over-exploitation are frequent in the absence of monitoring and adequate management of the resource. Many aspects of water resource management are yet to be strengthened:

- Knowledge of the water resource, both surface and ground water.
- Development of the watershed-based Integrated Water Resources Management (IWRM) approach, particularly through its local variations.
- Balanced, negotiated and regulated approach to the multi-use management of water resources in watersheds.
- Sponsoring/implementation of investment programs by cross-border river basin agencies: what issues and problems?

⇒ **Models for allocating cross-border river basins' water resources exist, they must be taken into account for planning irrigation development.**

⇒ **It is necessary to strengthen the knowledge and integrated management aspects of the resource (surface and underground), particularly at the local (sub-basin) level.**

⇒ **A better use of the resource is based on the diversity of irrigated systems optimally combining resources in the different seasons.**

IV. How to support this development? Towards the scaling up of available and tested solutions

The solution concept

Irrigated systems are complex systems because they drastically change the existing production systems and impose major constraints on producers: new cropping calendar, labor and equipment needs, financing of the agricultural season, difficulties in marketing the production etc. By eliminating the "water" risk, irrigation carries other socio-organizational and economic risks. It is essential to anticipate them so that they can be managed by producers, alone or with external support, depending on the complexity of the systems.

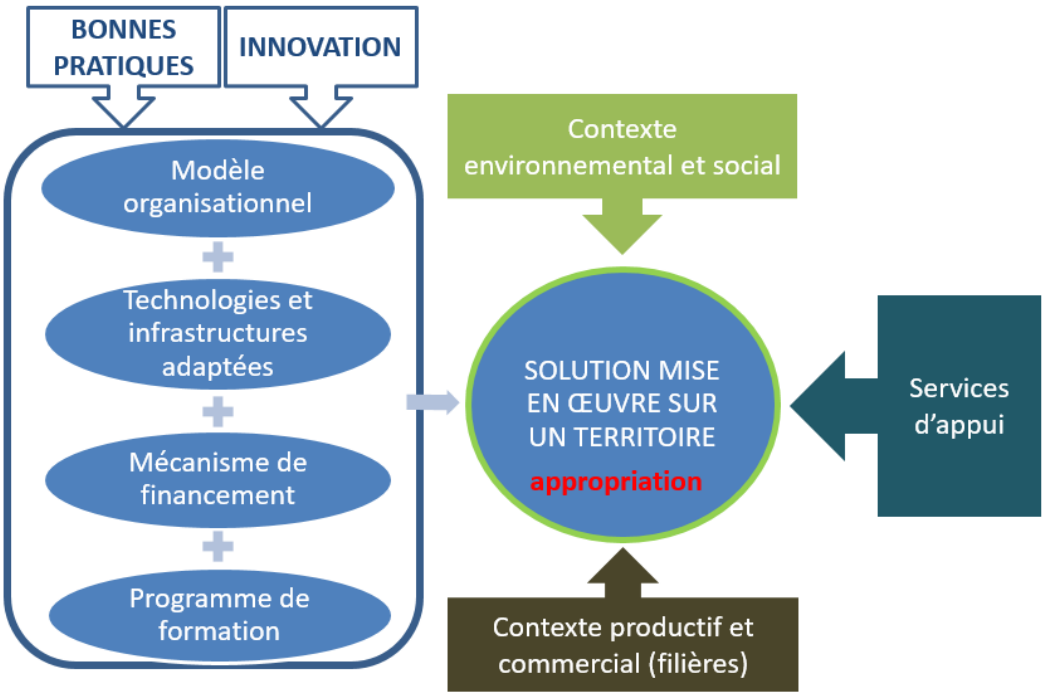
The Initiative makes use of the "**solution"** concept in putting efficient irrigation systems in place for the long term. These solutions help to make agricultural water investment adapted to the constraints and potential of the territories or production basins, to the public resources that the State can provide and to the aspirations of producers engaged in a participatory approach.

Solutions are defined on the basis of what works in the six States, "good practices" (often informal processes that need to be identified, enhanced and recognized), while leaving room for innovation. It is through localized co-construction processes that the most appropriate solutions will be identified and formalized, which requires a strong involvement of irrigators and field operators, in partnership with research, and the use of modern capitalization and knowledge management tools.

An irrigation solution includes the implementation approach, modalities and the specification of the activities to be carried out for the development and management of efficient irrigated systems. It is based on the description of four major elements: (1) an organizational framework (structuring the roles and responsibilities of the various actors and formalizing interactions, including water and land tenure management aspects), (2) a technical irrigation system including the infrastructure and equipment (3) a financing mechanism for the investment phase on the one hand, and coverage of operating and maintenance costs on the other hand, and (4) stakeholder training actions to put them in a position to implement the solution. One solution thus proposes a comprehensive implementation approach for a given type of irrigated system. There may be several solutions that meet the specific needs of a type of irrigated system.

The solutions are implemented in territories or production basins taking into account the local specificities of the environmental and social setting as well as the productive and commercial context. The objective is to integrate the development of irrigation in local planning taking into account the potential of the region and the sectors. The issues of scale need to be taken into account in the planning process to ensure the sustainability of the solutions implemented. This viability depends primarily on the availability of support services - from pump repairers to financial services - whose sustainability can only be ensured if a sufficient level of demand is maintained over the years.

Figure 7. Representation of the solution concept



Source: authors

The Initiative promotes the implementation of large-scale solutions, taking account of existing systems, in order to generate the economies of scale that will reduce costs and improve competitiveness. This at-scale implementation requires vast efforts to train actors (included in the solution concept) but also the harmonization of interventions around the principles adopted for each solution. To that end, the Initiative encourages:

- **The planning of investments and public support based on consultative processes and an operational knowledge of territorial issues**: availability of productive land/water resources, socio-economic profile helping to assess allocations (funds, labor, land, social capital, etc.) and the logic of the potential beneficiaries' action, the level of integration in the sectors, environmental and social risks.
- **The institutionalization of solutions** through (1) a common understanding of the solutions so that actors work towards the harmonization of practices on the ground, (2) a substantial capacity building effort for all actors in charge of applying or implementing them, particularly the States' technical services.

A pooling of resources at the regional level in the form of support functions will enable the States to move forward together, mobilize their partners and benefit from the experience sharing.

⇒ **Solutions combine an institutional model, adapted infrastructures and technologies, a funding mechanism, and a training program for actors in order to meet the needs of a given type of irrigation system.**

⇒ **The solutions must be implemented as part of a consultative programming of investments in relation to territorial and market issues.**

⇒ **The similarity in issues and contexts among the Sahelian countries argues for a pooling of the knowledge needed to implement solutions.**

What ambition for large-scale Sahelian irrigations?

As indicated in the previous chapter, there are various types of irrigation in the Sahel with small, medium and large-scale systems making possible different levels of water control. The relative importance of the changes advocated under the Dakar Declaration varies according to the five main types of irrigation schemes:

- Type 1: improvement of rainwater mobilization (controlled submersion and lowland developments generally on a few dozen to a few hundred hectares managed by village communities or municipalities).
- Type 2: individual irrigation of high-added value agricultural products (individual or corporate schemes of less than one hectare to a few dozen hectares).
- Type 3: small and medium-scale irrigation managed by village communities for the food needs of households and local markets (collectively managed schemes of less than 100 ha, externally funded, but with the possible contribution of the community, including Village Irrigation Schemes (VIS) and Small Vegetable Schemes (SVS)).
- Type 4: modernization and expansion of existing large-scale public irrigation schemes, and particularly those under rice cultivation, (100 ha to more than 1,000 ha schemes, publicly financed through a development corporation, with the possible involvement of beneficiaries, managed by traditional farmers structured into producer organizations).
- Type 5: PPP-based commercial irrigation (national or export markets) with areas ranging from a few hundred to a few thousand hectares. The schemes are publicly financed subject to compliance with specifications by private (agro-industrial) entrepreneurs, which may include service provision to family producers settled on the same land.

It appears that very substantial areas can be developed in the form of a large number of small community schemes (Types 2 and 3) or even individual micro-schemes (Type 1). For all types of resources, small-scale irrigation accounts for 80% of irrigated areas in Mauritania, 65% in Burkina Faso and Senegal, 55% in Niger, 25% in Mali and 10% in Chad.[14]

Table 4. Areas under small-scale irrigation (lowlands and controlled submersion, private and communal)

Existing	320,000 ha
The six countries' investment portfolio	335,000 ha

Source: AQUASTAT data and country portfolios 2015

These types of schemes often have much lower costs than large irrigated schemes. If implementation problems are similar, solutions are local and therefore have a lower level of complexity. These systems, however, require quality services to perform development, operation, and maintenance functions. For these services to be economically viable, the schemes must be grouped into sufficiently dense clusters. Moreover, structuring water development projects may be necessary to secure water supply, drainage and flood protection. On the other hand, the associated infrastructure to facilitate market access (roads, storage and service buildings) is required in most cases.

The financing of small-scale irrigation schemes is a key issue, especially with regard to type 2, which pertains to private initiative. Too often, grants paid by projects to beneficiary groups result in the exclusion of the private sector; these groups have no interest in striving to sell quality products when free or very low-cost distributions are taking place on the other hand.

The following box shows the example of a major small-scale irrigation program that has achieved

[14] See the Task Force's Water Resources Report, BRLi 2015

quite remarkable results in the unstable region of northern Mali.

Box 3. Village irrigation and controlled submersion in unstable regions: The case of northern Mali

The Mali Nord / IPRODI (GTZ-KfW) program has been operational since the early 1990s, and this support to northern populations continued in 2016. Some village irrigation schemes of humanitarian emergency (ECHO) equipped with motor pumps were subsequently developed by the PMN/IPRODI. Beneficiaries contribute 50% of the cost of the motor pump.

With regard to the developed areas, there are about 16,000 ha of VIS and about 40,000 ha of CSS (Controlled Submersion Structures regulating the supply and drainage according to the flood stage) on 150 improved ponds. These are used for growing floating rice in flood periods, and sorghum, millet, maize, cowpea, cassava, squash and gourds in recession periods. Bourgou, or Echinochloa stagnina, very popular forage, is grown in the branches of the Niger River.

Village irrigation and controlled submersion complement and diversify rainfed and recession crops, providing additional food and income in the dry season. Despite the security and political problems, these practices continue because they meet rural families' needs with modest investments.

Major publicly-initiated schemes (Type 4), although they do not represent the majority of existing areas or potential, nevertheless contribute significantly to the development of irrigations. Their size allows economies of scale that are conducive to the structuring of the sectors. On the other hand, they pose complex problems of governance and water management. The management of environmental impacts requires increased attention: significant withdrawal of the resource, crop intensification, loss of soil fertility, sanitation problems and the development of water-borne diseases are some of the problems commonly encountered in large-scale schemes. The recommended approach is to focus on improving irrigation and drainage services for more efficient use of water and increased productivity, and on managing impacts. These are therefore, first and foremost, technical and institutional modernization actions. The expansion of existing systems can be pursued in parallel with modernization actions, as part of development plans taking into account these performance improvement and impact reduction aspects.

Table 5. Areas under large-scale irrigation (types 4 and 5)

Existing	280,000 ha
The six countries' investment portfolio	175,000 ha

Source: AQUASTAT data and country portfolios 2015

Solutions involving agribusiness-type actors (Type 5) are also taken into consideration, as they can add value in terms of socio-economic impacts for local populations. These are PPP (Public Private Partnership) type approaches in which private investors are subjected to specifications aimed at maximizing positive socio-economic impacts on local populations (by developing tools in the form of contract farming for example).

The Sahel Irrigation Initiative promotes the adoption of a scaling-up strategy in which priority is given to the performance of existing systems. Given the financial stakes involved, the States cannot afford to increase the number of irrigated hectares, knowing that other schemes have been abandoned for lack of profitability. Where irrigation develops spontaneously, it must be supported to benefit from good practices that emerged elsewhere. The new developments are designed taking into account achievements and lessons learned from existing developments.

⇒ **The Initiative promotes planning for the scale-up that takes into account the viability of services, access to markets and development of the existing infrastructure**

The necessary adaptation to the local context

Although the structuring of interventions around the solution concept improves the quality of implementation and promotes economies of scale, these solutions must however be adapted to the local context. The risk would be to apply ready-made approaches to different environments. This adaptation is itself part of the solution and must necessarily be included in the participatory approach that will be established within the organizational model for each solution.

The key principles for successful adaptation to the local context are as follows:

1. Plan irrigation development in production basins taking into account scale effects and environmental impacts and considering all development options.
2. Analyze the inclusion of irrigated production in local production systems taking into account the diversity of these systems, based on a typology of producers, distinguishing vulnerable groups, women and youth.
3. Support the sectors to ensure the competitiveness of products and integrate into development plans the infrastructure and services necessary for marketing and support for producers (roads, storage, service centers, etc.)

The implementation of principles 1 and 2 is primarily based on pre-development studies and targeted research activities to better characterize the diversity of production systems. It also involves carrying out monitoring activities at the level of production basins (typically 5 to 10,000 ha areas) to characterize the dynamics of their development and space occupation. A fundamental aspect of this monitoring naturally concerns the knowledge of the water resource, especially the groundwater resources, and more generally knowledge of the environmental impacts.

The use of the most modern technologies, particularly Information and Communication Technologies (ICTs), satellite imagery or drones can significantly increase the speed of implementation and therefore reduce the cost of this type of studies and monitoring, while ensuring the quality of information through a multidisciplinary approach. The approach promoted by the Initiative is to develop and make available to the actors the appropriate tools. This may include, for example, making available in the form of a public good, precise topographic maps covering large areas, through the use of radar technologies. The implementation of these activities ahead of the appraisal of investment projects would expedite their preparation.

Concerning environmental impacts, the Initiative promotes the implementation of strategic impact studies at the production basin and/or watershed scale. Studying the impact of a VIS in isolation is of little interest if it is part of a "cluster" of schemes. This is particularly true for hillside reservoirs. The strategic impact study is also a good tool for dealing with the cumulative impacts of large-scale developments that are the subject of expansion projects. A good example is the Office du Niger Hydro-agricultural Development Program (PAHA) study.

The implementation of the 3rd principle is more complex and requires a whole range of activities including both investments and recurring needs. Needs also depend on the type of irrigated system considered.

Box 4. Marketing, a major but variable requirement depending on the systems

Irrigators from intensive collective systems (Types 3 to 5) must be integrated into reliable and regular marketing channels. The non-marketing risk has immediate consequences on performance and sustainability. For large rice-growing schemes (Type 4), which are particularly concerned, this refers to a national challenge of competitiveness and organization of sectors. Agribusiness schemes (Type 5) usually include the marketing channel.

Extensive systems (Type 1: controlled submersion and improved polders) have lower yields than intensive systems, but the low cost of production reduces commercial and financial risks. When they involve large areas and many households (as in the Lake Chad Basin), they may prove to be a good investment, especially in the absence of technical alternatives (opportunity cost).

The development of small-scale vegetable irrigation (Type 2) should be considered at the production basin scale (or a cluster of schemes) to take into account the scale effect (lower marketing costs) in order to improve the competitiveness of production.

Prior to implementing development, marketing aspects must be taken into account in the studies: identification and characterization of outlets, market analysis if necessary, specification and sizing of marketing means and establishment of a realistic business plan. To carry out these studies based on adequate data, it is necessary to monitor marketed volumes and producer prices (on markets targeted for commercialization).

The next step is to plan and implement the associated infrastructure for storage (stores), disposal (roads) and marketing (markets, shopping centers, activity areas for processing industries and access to energy).

Solution elements by type of irrigated system

The solution concept is defined by type of irrigated system. Each solution element (organizational model, infrastructure and technologies, funding mechanisms and training needs) is specific to the type of system considered. General considerations are given in advance for each element. Table 7 and Table 8 give the specific characteristics of the solutions by type of irrigated system.

Organizational models

The aim is to put actors in a position of responsibility, thanks to a clear division of roles. First, the organizational model must address the project management issue. Public bodies can now perform more complex qualitative foresight, planning, coordination and regulatory functions and gradually transfer implementation functions to irrigator groups, support services and service providers. Existing models can move towards a better public/private/farmer balance to build social compromises around water sharing and risks. Effective transfer of management can only occur if irrigator groups are recognized and have legal and moral personality.

With regard to small-scale irrigation (Types 1 to 3), the aim is to decentralize the process at the local level in order to put producers in a position of responsibility, i.e. to entrust them with the supervision of their scheme while providing professional support through Project Management Assistance (PMA) entrusted to service providers trained for this purpose.[15] When the conditions are met, the PMA

[15] There are many cases of project teams becoming providers, upon completion of the project, and who would make valid project management assistants. In some countries, companies specialized in delegated project management have been created by the State.

contract could take the form of a Delegated Project Management (DPM), to further decentralize the planning process. It must help to provide long-term assistance to the project manager, from the scheme design phase to development support, in order to make the provider accountable for the final result. Implementation tools consist of (1) a clear contractual framework for the PMA and the DPM, (2) a performance monitoring and management system to ensure the quality of services.

In large-scale projects under the responsibility of a SAGI, the latter acts as the DPM on behalf of the State which is the owner. The governance and the exploitation of the systems are however shared between this company and Agricultural Water User Organizations (AWUOs) which are associations, cooperatives or EIGs. The respective roles of the State, SAGIs and Water User Associations (WUAs) need to be clarified. The key tools are (1) the tripartite performance contract between the State, the SAGI and users and (2) the contract for the transfer of on-farm developments to the AWUOs. It is possible to delegate certain services to the private sector or to autonomize the commercial services rendered to AWUOs (case of the Autonomous Maintenance Division at SAED). In addition, models of concession to the private sector can be developed for SAGIs.

Organizational models also include clarification of land rights and water rights. The approach to the former is provided in the next section. Regarding the latter, it is fundamental that the rights allocated at the entry point of the development are incorporated into the water regulations applicable to individual users.

Box 5. Water rights of the Alatona scheme in the Office du Niger area, Mali

The Alatona scheme project in the ON area broke new ground by allocating two plots to each irrigator, one for rice and the other for the off-season. The second plot is located at the top of the network, which helps to dry the rest of the network in the dry season when the resource is scarce. Water right is thus linked to the scheme's land structuring.

Organizational models must of course be adapted to the local context, particularly in case of revitalization, rehabilitation or modernization of existing schemes. Endogenous innovations will then be built through iterative processes according to local conditions. To carry out these processes, PMAs and DPMs, whether they are private small-scale irrigation providers or SAGIs, need to master the social engineering aspects they involve.

Local Authorities (LAs) play a growing role in rural development, which must be reflected in the provisions of the institutional model. LAs can inherit the role of project owner, an option that appears to be well suited to Type 1 irrigated systems. They can play a role in supporting the development manager, especially for conflict resolution. Finally, they can take charge of related infrastructure that fall under their responsibility. Framework agreements will be developed for this purpose.

Finally, a driving role remains to be played by decentralized State services and by professional organizations in the supervision of the process of implementing the organizational model.

⇒ **Describe and implement a participatory approach guaranteeing an informed commitment of the parties, with the establishment of the procedures for monitoring compliance with the commitments.**

⇒ **Decentralize in order to put producers in a position of responsibility, while ensuring professional support through Project Management Assistance (PMA) and Delegated Project Management (DPM) entrusted to actors trained for this purpose.**

Technologies and infrastructure

The technical approach is inseparable from the organizational structure as well as the mechanism for financing the development and its operation and maintenance. All these elements are linked by the concept of irrigation and drainage service. The technical approach is indeed a response to a need to bring water to the plant in time and at a given (affordable) price. Reflection on technologies and infrastructure must systematically link the design aspects to those of operation and maintenance.

The various tools that can be developed to improve the technical quality of developments, include:

- Quality assurance services, particularly at the study level, including model terms of reference, adaptable to the context, for the irrigated system design and/or operation and maintenance services.
- Model specifications, or even standards, for works and equipment.
- Estimated cost benchmarks.

Moreover, work on the quality and cost of small individual irrigation equipment must involve suppliers and distributors, through a constructive dialogue, with a view to offering a more comprehensive service to producers wishing to equip themselves, covering, inter alia advice on the choice of equipment and their proper use and after-sales service. This work will establish quality labels that will be the subject of targeted promotional campaigns. The equipment will be adapted to the various target groups, including women, according to their needs.

⇒ **Guaranteeing quality technical studies and work, a first prerequisite for sustainable and well-maintained irrigated systems.**

⇒ **Make widely available reliable equipment and related services through a dialogue with suppliers and distributors.**

Financing mechanism

Along with the technical approach, the financing mechanism must be conceived as part of the solution. Scaling up small-scale private and community irrigation can be considered only in the context of the establishment of a cost-shared funding mechanism for the development, prompting both the distributor to render a better service and producers to maximize profitability and, when the time comes, to renew the irrigation equipment. Issues to be considered include:

- Smart subsidies: harmonization, targeting and avoiding market distortions.
- Cost recovery: water service pricing on collective schemes taking into account renewal reserves in maintenance costs.
- Identification of the financing stakeholders and assessment of their capacity.
- Economic and financial study and a typical business plan combining the scale of the development and that of the production unit (the farmer) to (1) confirm the ex-ante viability, (2) choose the type of system and (3) determine producers' level of participation, with specific provisions for particular groups: vulnerable populations,

women and youth.
- Financing plan (model).
- Manuals for implementing the financing tools: shared-cost funds (including maintenance funds if applicable), credit line, guarantee, financial products, etc.

The reader is referred to the last section of Chapter IV relating to the financing of irrigation development.

⇒ **The financing mechanism concerns investment on the one hand, and the operation and maintenance of developments on the other hand.**
⇒ **There is a wide range of financing solutions available to the actors; they must be adapted to each type of irrigated system.**

Capacity building

Capacity building is certainly the most important component for the success of the solution concept. Scaling up is based on the availability of actors trained in the implementation of these solutions. The primary objective is therefore to improve the availability and the quality of the service delivery necessary for the implementation of solutions, covering the management of irrigated systems, access to adapted technologies, financial products, etc.

The capacity building approach includes the following activities:

- Know the target audience: identification and referencing of actors and assessment of their skills.
- Operational research financing conducted with field actors and dissemination of research results.
- Support for training: increasing supply, support for demand (grants and subsidies to actors).
- Quality assurance services in support to project owners, by targeting the most critical phases of the design of the development (identification, feasibility, impact analysis).
- Training modalities for the various types of actors and estimated costs, including identification of institutions tasked with the training.
- Manuals for implementing the training and capitalization practices.
- Consideration of cross-cutting issues, particularly the gender issue.

⇒ **Capacity building should improve the availability and quality of the necessary services offered for implementing the solutions identified.**

Efficient and fair management of irrigated land: one of the keystones of performance

Irrigated land tenure means both irrigable and irrigated lands, an essential requirement for production in any system, whether it is intensive or extensive, regardless of the level of water control. Its management is crucial and covers the following issues:

- In new developments, recomposition of lands: when to recompose? In which case is it preferable to maintain what already exists? From whom are lands taken and how much land? To whom is it given and how much? How to do it? Who is deciding?
- In existing land developments, land tenure security: what degrees of freedom and what level of security do, or should producers and investors have on the land they use?
- How can the developing and financing State, by acting on land tenure, encourage the virtuous behaviors that it expects from producers (maintenance and productivity)?

The land issue is the most significant for community land developments carried out with public funds, especially for new developments. It is essential that project owners use proven methodological tools to (i) avoid that, under new operations, "land-related problems" result in delays, blockages and, ultimately, impacts on the sustainability of the developments, (ii) allocate land plots in an equitable manner, compensate expropriated landowners and establish formalized rights. This requires that local land diagnostics be an integral part of the project cycle and be conducted upstream so that, after an in-depth participatory approach, the allocation process is discussed and validated even if it imposes technical adjustments. The gender issue needs to be taken into account in these processes to ensure that women's needs are taken into account and to avoid exclusion from the development process.

Land tenure security for irrigators in collective schemes carried out by public authorities promotes crop intensification and maintenance effort as well as the propensity to cover costs, which are two important requirements. For this purpose, long-term leases are an interesting instrument because the owning State thus retains the power to encourage development while clarifying producers' rights. However, the process of regularizing and securing land on existing irrigation schemes, where producers have been long-time residents, can awaken frustrations born of an authoritarian allocation process in carrying out the development. It is also an expensive, complex and lengthy process that can disrupt a perhaps informal, but locally accepted balance. With regard to what already exists, it may be more relevant to amend the rules towards a system of gradual sanctions for non-payment of water fees, the withdrawal of a plot of land being envisaged only as a last resort.

An action matrix on irrigated land has been developed to assist public action in public and private irrigation operations, on existing or new developments. Focused on consultation, it has three dimensions: (i) a good overall framing of hydro-agricultural development projects, (ii) management of the local social and land context of the hydro-agricultural development project, (iii) land tenure applicable to the parcel plan of the hydroagricultural development project. This work has shown that the improvement of the land framework is promoted by management at a local level but as part of a national policy. The Action Matrix is an essential instrument for assisting the States in processing applications, which have become frequent in recent years in some Sahelian countries, for the allocation of large areas of irrigable land, by foreign entities and thus avoiding the granting of discretionary "land rights" and "related water rights" but whose practical enforcement proves impossible.

The land issue also arises in terms of surface areas allocated to farmers. Too small an area allocated (depending on the country and the population density, below 1 or 2 ha) keeps farmers in a situation of poverty because they cannot generate enough surplus to feed their families (their priority) and regularly pay for irrigation costs at a satisfactory level. They face the risk of their land security being weakened.

⇒ **The problems associated with irrigated land and the methods designed to anticipate and manage these are well-known. Implementing them on the ground and on a large scale is a vast, long-term but unavoidable project that must be conducted by ensuring that the gender issue is taken into account. Successfully allocating land for new collective public development projects is the first priority in this area.**

Table 6. Existing innovations for land tenure systems that secure farms

Innovation/practice	Actions/mechanisms	Country of reference
Adaptation of land rights to the socio-economic context and to the types of allottees on irrigated areas	▪ Operating license with renovated specifications. ▪ Emphyteutic lease for PAPs owning lands.	Niger
	▪ Title deed for PAPs with pre-emptive right of the project on sale. ▪ Emphyteutic lease for allottees after an approval period of 3 years.	Burkina Faso
	▪ Farming Permit (PEA) of unlimited duration and transmittable, for farmers who have demonstrated their dynamism under the Annual Farming Contract (CAE).	Mali
	▪ Authorization to use related to the unlimited duration of development	Senegal
A system of gradual sanctions for non-payment of water fees	▪ Non-payment of water fees does not imply immediate eviction. ▪ The sanction mechanism is gradual: warning for late payment (Article 48), fine for one-year delay in payment (Article 49), eviction in case of proven refusal to pay the fee (Article 50).	Burkina Faso
Promote meeting between local land institutions and the hydraulic bureaucracy	▪ The consultations help to partially align local institutions with those of the scheme. ▪ Lineages have formed an Economic Interest Grouping so that the management of the plots allocated to the groupings reflects that of the lineages, but also to ensure that the allocated lands correspond to those of the lineages on which the scheme has been established	Senegal
Supervision of agro-industrial projects	▪ Local communities turned away investors following consultations on the Ngallenka scheme (440ha).	Senegal
	▪ The Bagré Growth Pole supervises investment projects. If they are selected by the management agency, they are awarded a temporary 3-year lease, followed by a long-term lease contract if development has occurred. ▪ The water fee is higher for agro-industrial projects than for smallholders.	Burkina Faso

Source: The Task Force's Land Report, July 2015

Table 7. Features of the five types of irrigation

Type of irrigated system	**Type 1**: Use of rainwater (lowlands, small dams and sills, and controlled recession)	**Type 2**: Small-scale private irrigation	**Type 3**: Community-initiated collective irrigation	**Type 4**: Large-scale public schemes	**Type 5**: PPP-based agribusiness schemes
Objective	▪ Partial water control to increase rainy season production ▪ Water table recharge to increase off-season production (link with private irrigation Type 2)	▪ Diversification towards high added-value crops ▪ Increased income for smallholders	▪ Local food security and diversification ▪ Reduction of rural-urban migration and job creation in villages	▪ Expansion of large existing developments to strengthen their role as agricultural growth poles ▪ Improve management and cost-recovery and manage environmental impacts	▪ Mobilize private investments ▪ Secure the irrigation service through the technical and financial contributions of private investors ▪ Provide smallholders with contract farming opportunities
Description	▪ Combination of small to medium-sized public collective developments (small dams, dikes, etc.) and developments on a parcel basis (bunds, smoothing, etc.) ▪ Usually publicly-initiated developments, without individualized service to users	▪ Informal irrigation, peri-urban irrigation ▪ Small and medium-sized private vegetable and tree-growing schemes ▪ Irrigation by individual pumping in small dams and waterbodies or from the water table	▪ Irrigation schemes carried out by the village community providing individualized service to users: Village Irrigation Scheme (VIS) and Small Vegetable Scheme (SVS) ▪ Pumping (or intake from dam) and distribution through channels	▪ Developments under total water control or controlled recession supported by public authorities through a public operator	▪ Partnership agreement between the State, rural communities and investors on (i) a process of land consolidation and allocation of part of the land to investors, the rest to local producers, (ii) development of productive infrastructure including irrigation and (iii) sustainable management of the water service
Main crops	▪ Rice (lowlands) ▪ Sorghum, millet and maize (controlled recession)	▪ High value-added crops: market gardening and arboriculture	▪ Rice and market gardening	▪ Rice and market gardening	▪ Industrial crops, cereals and market gardening
Size and cost	▪ A few dozen to hundreds of hectares ▪ Cost of about USD 500/ha (developed lowlands) but up to USD 20,000/ha for small dams	▪ Cost of access to the resource: variable depending on the distance to the water body or the depth of the water table ▪ Dewatering and distribution cost: USD 1,000/ha for micro-California system with thermal pumping ('VISA' type up to 3 ha); USD 2 to 5,000/ha for small-scale irrigation: 1 to 10 ha	▪ Generally 5 to 50 ha (<10 for SVS, 20 to 50 for VIS) ▪ Unit cost 5 to 10,000 USD/ha	▪ Several hundred to several thousand hectares (see Table 8) ▪ Unit cost > USD 10,000/ha (total control)	▪ Several hundred to several thousand hectares ▪ Cost > USD 10,000/ha
Opportunities and risks	▪ Enormous potential (2 million hectares) ▪ Land tenure and use right settlement issues ▪ Maintenance cost recovery ▪ Partial water control being an obstacle to intensification	▪ Growing demand and high potential along major rivers but also on small dams and on boreholes ▪ Income generation for women and youth ▪ Possibility of developing solar pumps ▪ Private investment development ▪ Risk of the resource being overexploited	▪ High potential along the major rivers ▪ Mobilizing community dynamics ▪ Fragility of community management systems	▪ Existing infrastructure the potential of which is not fully exploited ('sunk cost') ▪ Structuring role in the economy and the sectors, economies of scale related to the volumes produced ▪ High environmental and social risks	▪ Leverage effect given to public financing ▪ Creation of new business opportunities (processing and marketing) ▪ Delegated management of the water service ▪ Risk of exclusion of certain producers during the implementation of the land consolidation process

Table 8. Challenges of the five types of irrigation

Type of irrigated system	**Type 1**: Rainwater utilization	**Type 2**: Small-scale private irrigation	**Type 3**: Community-initiated collective irrigation	**Type 4**: Large-scale public schemes	**Type 5**: PPP-based agribusiness schemes
Organizational challenges	▪ Involvement of local authorities in project management and importance of the participatory process ▪ Establishment of user committees: governance and rules of procedure, use right management (risk of the scheme being degraded by animals) ▪ Land consolidation: realignment of parcels if necessary	▪ Privately initiated developments, with or without a subsidies, led by individuals or groups ▪ Subsidy administration ▪ Guidance to producers, particularly in terms of marketing and establishment of FOs ▪ Possibility of multiservice delivery centers ▪ Taking into account marketing infrastructure needs in local development plans ▪ Establishment of water resource monitoring and management systems (water right when the resource is limiting)	▪ Project management by a water user organization (WUOs) which must have appropriate status and powers ▪ LAs' support role to be strengthened (convention) ▪ Support services for WUOs particularly management consultancy (possibility of multiservice centers) ▪ Possibility of delegating the pumping service to the private sector ▪ Land allocated in relation to each beneficiary's contribution to investment ▪ Establishment of FOs by sector to facilitate marketing ▪ Establishment of water resource monitoring and management systems (water right when the resource is limiting)	▪ Public operators' governance issues: strengthening administrative and control processes and increasing independence from political influence ▪ Performance of operators: management by objectives based on framework contracts ▪ Role of users in the management of on-farm developments: ensure transfer of management to WUOs at an appropriate level (transfer contract) and manage the interface between the public operator and user associations (water service contract)) ▪ WUOs' governance issues: developing the legal, support, and control instruments necessary for the enforcement of common rules ▪ Production and market access: establish/strengthen FOs ▪ Advisory support: establish/expand multi-service delivery centers ▪ Land: transparency of the land allocation, security and management process adapted to the needs of farms, including expansion and settlement of young people and involvement of LAs ▪ Possibility of delegating management to the private sector	▪ The issue is to define the terms of an agreement that is acceptable to all parties: importance of the participatory process ▪ Land consolidation is a complex and risky process from the perspective of both communities and investors: agreements must preserve the interests of the community, individuals within the community and guarantee private investments ▪ WUOs are established as an interface with the private operator
Technical challenges	▪ Technical design for the optimization of water control at the best cost/benefit ratio ▪ Quality of implementation: development standards to be met ▪ Labor-intensive method of implementation ▪ Collective rules of water control	▪ Development of material supply chains ▪ Quality of the equipment (quality/price ratio) and related services ▪ Quality of the technical advice to producers	▪ Reduced development costs by using adapted technical standards and implementation by pieceworkers ▪ Choice of the Pump Unit: reliability and maintainability ▪ Efficiency of distribution and impact on pumping cost ▪ Level of protection against floods ▪ Diversification of production to make the developments profitable ▪ Marketing of products	▪ Development plans taking into account the cumulative impacts ▪ Quality of studies and works: improve the terms of reference and establish a quality assurance process ▪ Change in development standards to (i) improve water service and the efficiency of distribution and (ii) reduce development costs ▪ Monitoring of water consumption	▪ Appropriate development standards must be defined to meet investors' needs and give the necessary flexibility to smallholders so that they can adjust their production to market demand ▪ The parameters defining the water service must be clearly established in the private operator's terms of reference

The financing issue	▪ Moderate cost (lowlands and recession) but difficulty in mobilizing contributions because the service rendered is not uniform ▪ High cost of development (small dams) ▪ Mobilization of funding from decentralized authorities (inclusion in maintenance budget)	▪ Smart subsidy: avoiding market distortions and targeting beneficiaries ▪ Developing incentives for advisory support operators and suppliers (Result-based subsidies) ▪ Access to bank financing (initial investment and/or renewal of subsidized equipment) ▪ Developing new financial instruments (leasing) ▪ Marketing the production (warrantage)	▪ Mobilization of the initial contribution (kind or cash) ▪ Recovery of the irrigation fee ▪ Provisioning for renewal of the Motor Pump Unit ▪ Financing of the revitalization of abandoned developments (major maintenance) and of modernization	▪ Financing of structuring developments by the State (framework contracts) ▪ Mobilization of private financing in support of public financing for extensions: fundraising by operators on the basis of a concession or through the beneficiaries' contribution, in return for a land title or a lease of sufficient length ▪ Evolution of water pricing to take into account the economic value of water and the real service cost, allowing for the long-term financial equilibrium of operators and WUOs ▪ Strengthening fee collection procedures	▪ The procedure for selecting private operators must take into account the amount of their contribution to the investment ▪ Financing facilities and guarantee instruments may be established for investors ▪ The pricing of water must be carefully defined to ensure the financial stability of the water service while being affordable for all types of producers involved ▪ Deal with the specific issues of asset renewal and transfer at the end of the contract
Training needs	▪ Management Committees: governance and management of user rights ▪ Local authorities' decision-makers and staff: role of project management ▪ Advisory support providers: delegated project management, participatory approach and financing package ▪ Consultancy firms: adapted development standards ▪ Jobbers for construction and maintenance	▪ Suppliers: equipment sold that meets producers' needs and quality of the after-sales service ▪ Services: repairers, rental companies and multi-service centers ▪ Supervision: support-advisory operators in charge of assisting producers in developing their business plan and choosing the right equipment and administering subsidies	▪ WUO: establishment of sustainable collective management ▪ LAs: support and conflict management role ▪ Advisory support providers: delegated project management ▪ Service providers (maintenance) ▪ Multi-service centers	▪ Public operators: strengthening management, corporate culture oriented on providing quality service, diversification of profiles to develop new management transfer approaches and financing mechanisms ▪ WUO: strengthening governance and management (via service delivery centers) ▪ LAs: strengthening support and conflict and land management roles ▪ Consultancy firms: new development standards, quality of design and consideration of new financing approaches ▪ Private providers: management delegation contracts	▪ The participatory process to define the terms of the agreement is essential and requires high-level expertise ▪ The private operator's specifications may assign it a role as regards training ▪ Independent support is needed for the traing of WUOs
Resources, documentation & successful experiences	▪ Inland Valley Consortium (AfricaRice) ▪ Experience of Burkina Faso (small dams and lowlands) ▪ Experience of Mali (small dams and lowlands): PNIP ▪ Niger and Chad: water table recharge thresholds	▪ Capitalization of experiences on the development of high added-value small-scale private irrigation in West Africa, 2011 ▪ VISA project in Mauritania ▪ PIP2 project in Niger and SPIN	▪ Experience of Mali (VIS): National Local Irrigation Program (PNIP)	▪ SAED (Senegal): transfer of management to WUOs, establishment of maintenance funds and Autonomous Maintenance Division (DAM) ▪ Office du Niger (Mali): development plan study (PAHA), joint management model and its limitations ▪ ONAHA (Niger): reform process underway ▪ AsIrri studies, capitalization of good practices, etc.	▪ Solutions under experimentation in Senegal (PDIDAS) and Burkina Faso (BagrépÔle) ▪ International experiences to build upon (Bangladesh, Swaziland and Zambia)

What financing for developing irrigation?

Multi-level needs

The financing needs of irrigated agriculture cover different types of activities:

- investments: new developments, extension of existing developments, but also the need for revitalization and modernization of existing developments and related infrastructure such as roads, power lines and warehouses,
- the coverage of operating and maintenance costs including the renewal of equipment,
- and the financing of agricultural equipment and working capital for the crop year.

For all these activities, financing needs include, in addition to studies, infrastructure and equipment, management, consulting, monitoring, evaluation, control and training aspects as well as all related service activities to ensure the viability of the irrigated systems and the sustainability of their exploitation. This includes in particular land management and water resource management needs. It is absolutely crucial that for these support and service delivery activities the necessary resources be allocated at a sufficient level, and this, for all investment projects without exception[16].

These various financing needs require a variety of funding sources including (i) the State and local authority budgets; (ii) the contributions of the beneficiaries of the developments; and (iii) the private sector's investments. The financing mechanisms must make it possible to combine as efficiently as possible these different sources of funding.

⇒ **Take into account the different levels of financing need in development plans and make the best use of the different sources of funding available.**
⇒ **In particular, ensure that support activities are taken into account at a sufficient level.**

Priorities of public funding

The State's responsibility relates primarily to the financing of sovereign services that maintain a favorable productive environment for irrigated farms. These include monitoring and controlling the exploitation of natural resources, starting with water and land, providing basic services such as connectivity, transportation and energy, allowing for the development of an appropriate training offer and maintaining a business environment that encourages investment and facilitates trade.

The State can also allocate its resources to the development of structuring water infrastructures that can increase the capacity to mobilize the water resource and open new areas to irrigation. This also includes drainage and flood protection. This responsibility can be shared with investors.

Finally, the State can support investments in irrigation water supply (corresponding to on-farm developments), either directly through the realization of assets, in the form of subsidies to operators or producers, or finally through specific tax policies (tax reduction for irrigation equipment). This public funding will generally target specific groups. For example, women and youth, and more generally groups considered vulnerable, can enjoy stronger public support (higher subsidy rate, additional support measures, etc.).

The countries' investment programs will be based on the consolidation of what already exists

[16] Indicatively, the cost of services related to the development process can be estimated at 25% of the cost of the works.

(rehabilitations, revitalization, performance improvement and transfer of management) and on supporting the spontaneous dynamics of irrigation and peasant schemes (lowlands , small dams, vegetable schemes, etc.) that can be seen in the field. In particular, simple, robust, efficient irrigation systems that require little external support must be taken into account in order to achieve the Dakar ambitions. The graph below provides elements for comparison of the different types of irrigated systems in the Sahel with regard to the cost and complexity of implementation, based on recent experiences (~ past 10 years).

Figure 8. Minimum and maximum cost for developing the different Types of irrigated systems

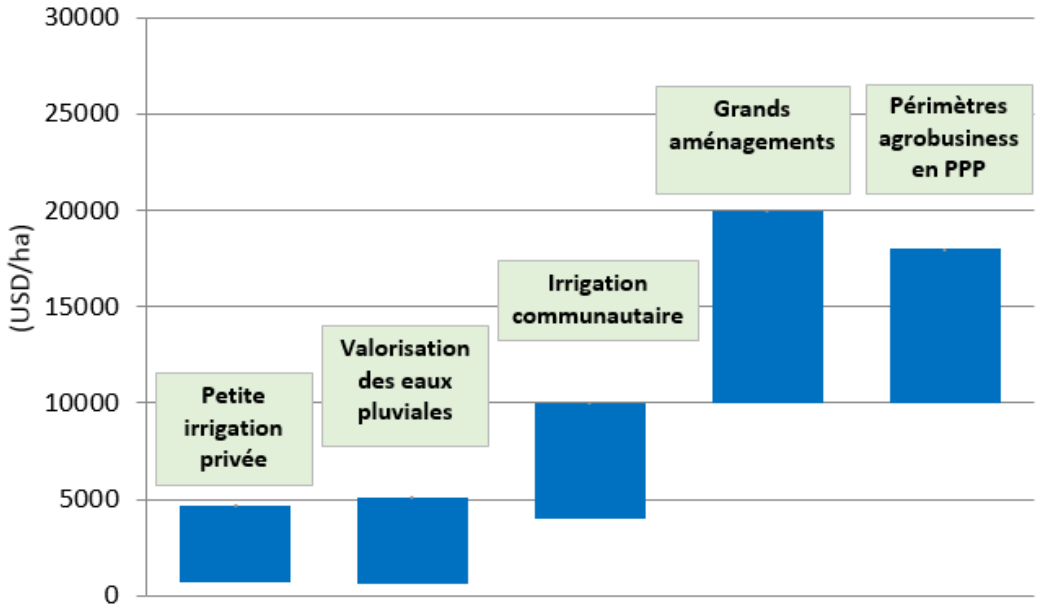


Table 9. Complexity of the various types of irrigated systems

System area	*0.1 to 10 ha*	*10 – 100 ha & more*	*5 – 50 ha*	*100 – 2,000 ha & more*	*100 – 1,000 ha & more*
Organizational Complexity (1)	*0*	*+*	*++*	*+++*	*+++*
Technical complexity (2)	*+*	*++*	*+*	*+++*	*+++*
Financing Complexity (3)	*++*	*+*	*++*	*+++*	*+++*
Capacity building complexity (4)	*+*	*+*	*++*	*+++*	*+++*

(1) Cumbersome participatory process, risks of land blocking, degree of collective self-dependence, dependence on external operators and compatibility with farmers' logics.
(2) Complexity in studies and the construction, quality of the equipment, time spent establishing the systems and irreversibility of errors.
(3) Contractualization of participation in the investment and targeting of beneficiaries (equity)
(4) Results from other complexities.

Source: authors, 2016

State funding can be supplemented by funds allocated to local authorities as part of decentralization processes initiated in several Sahelian countries (see Box 6). The use of funds from local authorities is required especially for Types 1 and 3, which are generally included in the local development plan, and in the management of which the community must continue to participate.

Box 6. FISAN, ANFICT and SPIN, three instruments to help local authorities participate in the development of small-scale irrigation in Niger

The National Local Authority Financing Agency (ANFICT) and the Investment Fund for Food and Nutrition Security (FISAN) established in 2014 and 2015 and which are being made operational complement each other to facilitate the development by the municipalities of structuring investments such as water spreading weirs, ponds and small dams. FISAN is an agricultural development fund geared towards investments, agricultural credit and subsidies. For investments, it will allocate resources to ANFICT and will support it in planning their allocation to ensure coherence in carrying out the investments, complementarity among stakeholders, the use of common conditionalities and mechanisms. ANFICT will act as a bridge with local authorities while strengthening their project management capacity. The Small-Scale Irrigation Strategy (SPIN), which dates from 2015, gives priority to this project management by local authorities to enable them to be in charge of planning, programming and technical and financial monitoring. SPIN also provides for funding request mechanisms for producer groups or individuals as well as differentiated rates.

⇒ **Ensure the financing of sovereign services as a priority.**
⇒ **Take into account the diversity of irrigation in investment planning.**
⇒ **Take into account the needs for revitalization and modernization of existing schemes.**
⇒ **Complete State funding with community funding, where appropriate.**

Mobilization of private financing

The objectives of the Dakar Declaration cannot be achieved with public funding alone. The use of private investment is essential. This mobilization can be done at all levels.

1. The recovery of actual operating and maintenance costs through appropriate pricing of the water service is an essential prerequisite for ensuring the sustainability of the infrastructure.
2. The implementation of a genuinely participatory approach for developing the schemes provides a significant contribution by beneficiaries to development costs. This contribution can be maximized through the use of suitable technical standards to reduce costs and facilitate in-kind contributions.
3. The allocation of a land plot (Types 3 to 5) or a development subsidy (Type 2) should be conditional upon the operator's justification of the coverage of financial needs relating to capital equipment and working capital (own funds or bank credit decision) to ensure its development on the basis of a credible business plan. This business plan can be accompanied by a subsidy or credit access support as well as other suitable innovative financial instruments.
4. The financing of developed lands must be considered in connection with land tenure security for irrigated land users, either through the acquisition of land with a title deed, or through a rental lease formula allowing sustainable farming by one or several successive farmers (mainly Types 4 and 5).
5. Other modes of financing of the scheme should be taken into consideration, including the raising of private funds by public operators on the basis of a State concession (Type 4) and public-private partnerships (Type 5).

⇒ **Mobilizing private funding starts with better recovery of operating and maintenance costs and with a significant contribution of the beneficiaries to development costs.**
⇒ **Contributions can be made to project funding by the beneficiaries, public operators, or private investors depending on the appropriate mechanisms.**

The use of innovative financial products

To fund irrigated agriculture on a large scale, the scaling-up advocated by the Dakar Declaration goes through making greater use of innovations developed in rural areas in recent years. These innovative financing techniques can be grouped into the following categories:

- Commercial financing: commercial credit, input supplier credit, marketing company credit and financing by a dominant firm.
- Receivables financing: trade receivables and factoring financing;
- Pledging of tangible assets: warrantage and leasing;
- Risk reduction instruments: crop/weather insurance and forward contracts;
- Financial incentive measures: securitization of agricultural financial asset groupings, credit guarantees, venture capital and PPPs.

In terms of innovation, we must not forget the aspects relating to capacity building for actors (financial management, cooperative management, knowledge of the logics of other actors by each link in a chain, etc.).

Even if none of these innovations is a recipe on their own, choosing to implement these credit technologies as often as possible should lead to greater security and better efficiency of agricultural financial operations and even result in agricultural finance stakeholders knowing each other better and collaborating more effectively.

A large proportion of the financial innovations is linked to contractual farming practices (inter-link financing, warrantage, leasing, factoring, etc.) and therefore to the need to finance agricultural production as part of sectors organized to formalize contracts. The implementation of these innovations is therefore as much linked to the need to structure agricultural finance as to a continuous work of structuring agricultural sectors.

⇒ **Many types of financial instruments can be used and combined to promote private fundraising by means of proper structuring of agricultural financing and related sub-sectors.**

Analysis of the States' investment portfolios

As part of its steering role in the sector, the State's main task is to manage the planning of medium- and long-term investments. This involves not only mobilizing financing to develop new land or rehabilitate existing schemes, but also sustainably financing the development and exploitation of irrigated areas.

In the inventory of existing projects in the countries' investment portfolios, 79.8% account for the creation of new areas and only 15.4% for rehabilitations of existing schemes. No distinction was made with regard to the intervention or no detail was given for 4.8% of the areas (see Figure 9). Overall, the six countries' cumulative portfolio amounted to 2.1 billion CFA francs in 2015 and represents approximately 524,000 ha to be developed, a goal close to that of the Dakar Declaration, without taking into account purely private

investments which are generally not counted in the States' investment portfolios. Funding has been obtained for slightly more than a quarter of this portfolio.

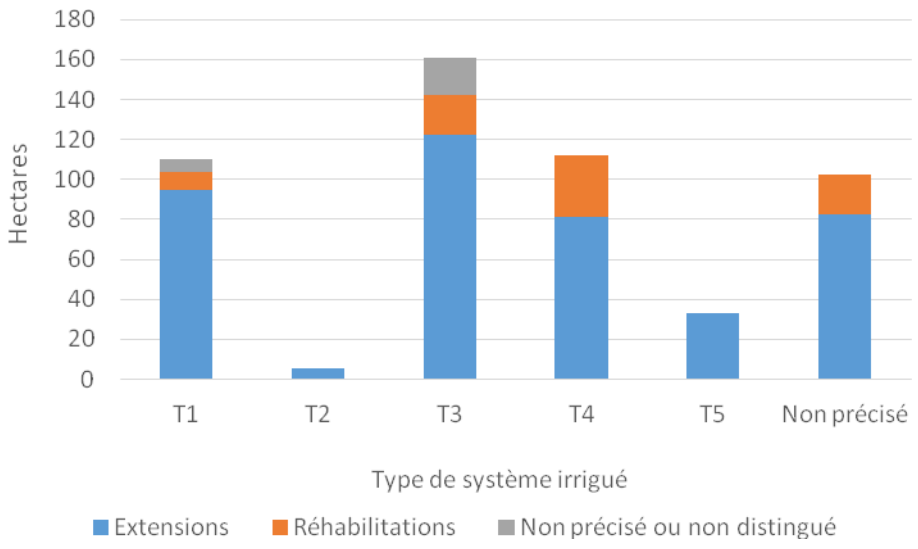
However, the analysis of the rate of expansion of developed areas shows that over more than 40 years, barely 35% of the irrigable potential has been developed. In absolute terms, taking the period of highest increase for each country, the average annual irrigated areas created for all six countries is around 40,000 ha. At this rate, it will take about fifteen years to reach the Dakar goal of one million hectares of irrigated land.

Moreover, it appears that less than two-thirds of the areas equipped for irrigation are actually irrigated (see Figure 4). It follows that the objective of the Dakar Declaration cannot be met merely by increasing developed areas but by combining the creation of new areas, the recultivation of existing areas, and increased crop intensity.

It also appears that public funds are allocated primarily to irrigation Types 1, 3 and 4. Type 2 has very little support. This can be explained by the fact that it a private type of irrigation that does not justify public intervention. However, this is an interesting opportunity for development that can help target specific beneficiary groups such as women and young people, which is inexpensive, does not pose management problems and maximizes the leverage effect of public funds on the mobilization of private funds. Moreover, this solution is very quick to implement. The States should therefore consider rebalancing their investment portfolios in favor of Type 2, as part of a process of comparative monitoring of the performances of the various solutions.

- ⇒ **It is essential that conditions for sustainable farming be taken into account in order to keep completed projects operational and avoid costly rehabilitations.**
- ⇒ **The objective of the Dakar Declaration cannot be achieved only by increasing developed areas. The revitalization of existing projects and increased crop intensity will also have to be taken into account.**
- ⇒ **The strengthening in the States' investment portfolio of the development of Type 2 irrigation systems is necessary to reach one million hectares of irrigated land within a five-year time frame.**

Figure 9. Countries' investment plans (in area)



V. 2iS: A Concerted Implementation Framework

Process of implementation of the Dakar Declaration

A multi-stakeholder Task Force

The Dakar Forum resulted in the establishment of a multi-stakeholder regional Task Force that oversaw the development of a Strategic Framework and a Regional Action Plan for implementing the objectives of the Dakar Declaration. CILSS has been mandated by the States to provide coordination. This Task Force was supported by the Technical Assistance of the World Bank with funding from the Water Partnership Program. It also received support from AFD and FAO, which focused on land issues related to hydro-agricultural developments. It met five times in the two years following the Forum. This Strategic Framework reflects the results of all this work.

⇒ **The Initiative is the result of a concerted process characterized by strong involvement of many actors.**

Design of the Sahel Irrigation Initiative

The Sahel Irrigation Initiative or 2iS is not a major water project. It is a process whereby six countries are working to improve the performance of irrigation in the Sahel and accelerate its development, in order to increase resilience to climate shocks and agricultural competitiveness. The initiative aims to establish irrigation solutions adapted to the Sahelian context, to disseminate them, mobilize funding and build the countries and stakeholders' capacity to implement them.

2iS offers a new vision, based on the solution concept, to support the changes in irrigated agriculture. This vision is based on a regional framework that identifies, assesses, tracks, articulates and promotes national programs and local initiatives: a portfolio of projects synergized with regional organizations and watershed organizations.

This framework is not only aimed at large-scale schemes but also launching a vast diversified support program for the various forms of irrigation under varied project management and various socio-technical schemes. It is aimed at *upscaling* while anticipating tensions (labor, capacities, land tensions, access to and availability of land, on the water resource, risks of overproduction, etc.) and the limits (supply management) of the development potential. It specifies the commitments of the parties (States, development companies, farmer organizations, local authorities, basin organizations, donors, etc.).

⇒ **The Initiative aims to answer the question HOW TO DO THIS (better, more and faster).**

A regional project to support 2iS

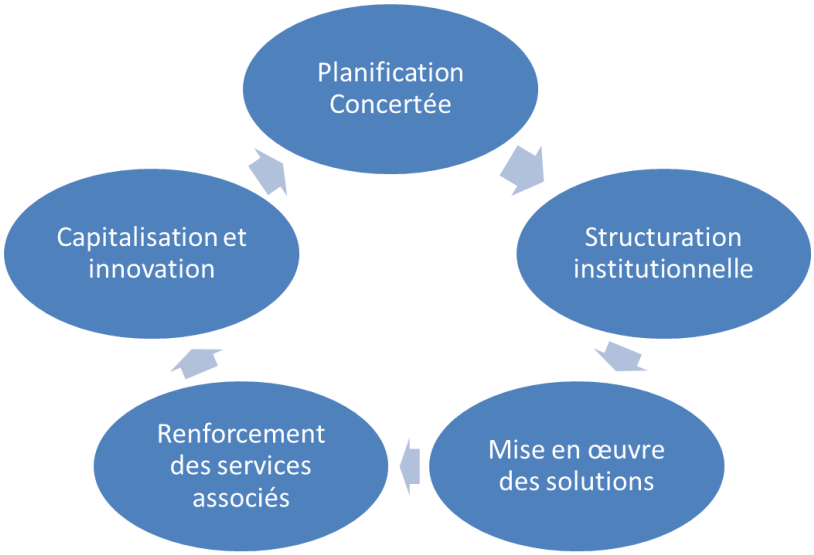
The World Bank is engaged in the appraisal of a regional investment project in support of the six countries, aimed at creating the conditions for the upscaling. This means increasing the capacity of the States, actors and partners to work together to accelerate investments and enhance the performance of irrigated systems for sustainable, environmentally friendly and socially harmonious irrigated agriculture. This project is currently being prepared by CILSS and the six countries.

The objective of this project is to improve irrigation development and management capacities and to increase developed areas in the Sahel countries by following a regional, solution-based approach.

It supports the definition of irrigation solutions, through the identification of good practices and targeted research-action measures, and their institutionalization based on the intervention logic presented on Figure

100.

Figure 10. Logic of the regional project to support 2iS



Source: Authors

⇒ **The implementation of 2iS is supported by a World Bank-funded regional project to establish and then institutionalize irrigation solutions.**

A charter of commitments for the implementation of the Initiative

Synergizing energies: the Initiative is first and foremost a commitment by all stakeholders to serve the above-cited objectives, in clarified roles and responsibilities:

- producers and their organizations test the solutions and are involved in the development of the collaborative programming of investments;
- agricultural irrigator organizations are interlocutors recognized by DPMs and SAGIs for the monitoring and evaluation of irrigated systems;
- public authorities support these organizations by providing services;
- professional organizations (umbrella organizations and chambers of agriculture) are invited to participate in the programming of investments;
- providers and development companies (SAGIs) are involved in the implementation of the Initiative (consultation, testing of solutions, programming, relays and training);
- TFPs support the 2iS Initiative;
- regional organizations and basin organizations are mobilized through the adaptation and harmonization of agricultural, food and environmental policies (water resources);
- research is mobilized and committed on the ground.

This commitment is supported by CILSS in its role as coordinator tasked with ensuring regional consistency and the sharing of knowledge and experience. It also benefits from the regional political support of WAEMU and ECOWAS.

The States' commitment to implement the Initiative

The States undertake to improve the performance of the irrigated sector through the implementation of the various components of the Strategic Framework presented in Chapter IV. This mainly includes:

- Taking into account the diversity of IS and production systems in the irrigated sector development policies by including the gender issue.
- The construction, based on field experiences and widespread implementation, of "solutions" for the development and management of IS, defining the institutional set-up, technical approaches, funding mechanism and training aspects.
- Taking into account environmental and social impacts in the process of developing and implementing the required mitigation and monitoring measures.
- The establishment of monitoring & evaluation and knowledge management systems with the involvement of the sector's actors by making the best use of available information and communication technologies.
- Using the lessons learned from these systems to improve the programming of investments and public support as part of concerted approaches at the national and local level.
- Communication on the irrigated sector and the sharing of useful information at the regional level.

The States undertake to have development programs and projects take into account the resources needed to implement all of these measures, with the support of their technical and financial partners. They shall in particular, ensure that IS management issues are taken into account in the design of new developments and make sure that the needed support is provided to improve the performance of existing systems. They shall allocate to producer organizations and to the various technical partners and training and research organizations resources in line with their commitment. They shall establish frameworks for consultation with stakeholders and ensure the availability of a training offer corresponding to the needs and possibly allocate targeted public aid to support the productive investments of intermediate actors (for example by subsidizing training). Finally, the States undertake to ensure the transparency of the programming and award of public contracts in accordance with the regulations in force.

A multi-stakeholder commitment to conduct the Initiative

Towards a multi-stakeholder contract of trust? Commitment by all actors is necessary for the implementation of the Initiative.

Commitments of producer organizations

Producer organizations undertake to participate in consultation processes on the establishment of "solutions" and on the programming of investments and public support. They shall act as liaison between producers and administrations. They shall aim to take into account, utilize and develop the know-how developed by producers in irrigation solutions. They shall contribute to the monitoring and evaluation systems of irrigated systems.

Commitments of providers (intermediate actors)

Intermediate actors such as consultancy firms, companies, field operators (NGOs and others), service providers and suppliers involved in the development and management of IS, are actively involved in implementing the Initiative in the form of:

- Contribution through the instruments at their disposal (particularly knowledge management tools), to consultation processes on the construction of "solutions" and on the programming of investments and public aid.
- Investments in training and work tools in order to be able to respond to the growing needs for service as identified in the programming processes.

Commitment of professional organizations

The organizations representing professionals such as professional chambers, unions or associations undertake to participate in consultation processes on the establishment of "solutions" and on the

programming of investments and public support. They shall act as liaison between professionals and administrations.

Commitment of training and research organizations

Training and research organizations undertake to actively contribute to the training and research effort required for developing the Initiative, by drawing up programs that meet the needs of States, producers and intermediaries. They undertake to maintain a dialogue with stakeholders on training and research priorities as well as develop a continuing training and action research offer that meets operational needs.

Commitment of donors

Donors undertake to structure their interventions in relation to the programming defined by the States and taking into account the typology of IS. In so doing, they support the change towards a programmatic approach to development assistance in the irrigated sector.

Donors are committed to ensuring the sustainability of their interventions by supporting the development and implementation of solutions developed by the States and by implementing project implementation modalities (structuring of roles, funding mechanisms, etc.) recommended for the various types of IS. They shall ensure that project durations are compatible with the modalities of implementing the solutions they are funding (including post-development support needs).

Donors undertake to contribute to the financing of monitoring-evaluation, knowledge management, training and research instruments developed under the Initiative, in order to ensure their sustainability. For this purpose, they shall finance the services implemented at the regional level either directly or through programs and projects in the States benefiting from these services.

Commitment of technical partners

International technical partners undertake to take into account the countries' priorities in defining their research and technical assistance programs as well as to strengthen cooperation with national agencies and institutions in the implementation of their programs.

Technical partners undertake to strengthen their actions to disseminate the results of their research, analytical work and technical assistance actions.

Technical partners undertake to share their expertise in order to contribute to high-level technical guidance actions, such as peer-reviews, task forces, think tanks, panel of experts, etc., through mechanisms approved by the States and CILSS and coordinated at the regional level by CILSS.

A regional dimension at the service of the Member States

Necessary regional coherence

The six States recognize the benefits of strengthened and structured collaboration to accelerate development and improve the performance of irrigation schemes of all types.

They undertake to implement this collaboration in the form of sharing of experiences at the regional level, harmonization of structured interventions by the typology of IS and the pooling of resources when economies of scale are possible.

This collective effort should make it possible to give a regional dimension to the measures taken by each country and also to considerably enhance the visibility of the sector, through communicating the results and impacts of investment operations and advocacy for mobilizing funds for the control of water in agriculture.

Knowledge Sharing

The States shall jointly develop shared knowledge capitalization tools including a Web portal and tools for networking actors, applications for tablets or smartphones, communication tools for actors and the public, information tools on sectors and markets, training and research programs at the regional level and all other useful services for which sharing makes possible significant economies of scale.

The States shall entrust CILSS with the development of these tools and pledge to ensure their long-term financing through financial contributions collected from development programs and projects using these tools.

Alignment and coherence of programs at the regional level

In order to structure and make effective the sharing of knowledge, the States undertake to consolidate together the solutions developed for the different types of IS, before adapting them to the local contexts encountered in each country.

The States undertake to develop, update and apply the rules and good practices in transboundary basin management in collaboration with basin organizations (OMVS, NBA, VBA and LCBC). They shall take into account water resource constraints in their irrigated sector development plans.

The States undertake to harmonize trade rules, particularly subsidies and possible tax exemptions, and to facilitate trade in irrigation equipment in accordance with international regulations and those of Regional Economic Communities (ECOWAS and WAEMU) mainly, as well as CAEMC and ECCAS.

The States shall cooperate to plan the development of irrigated agriculture commodity chains, so as to avoid the creation of harmful market distortions resulting from uncoordinated support policies.

The States shall entrust CILSS with the task of coordinating this process of alignment and coherence in close connection with transboundary basin organizations and with regional economic communities on matters which concern them.

Monitoring, data updating and information generation

Stakeholders shall recognize that monitoring data on water resources, land, and irrigated and non-irrigated areas is a crucial part of the investment planning process and the sustainable development of water resources. The production of information based on regularly updated and aggregated data at a regional level is an essential decision-support tool.

Stakeholders and States shall support CILSS to establish an efficient integrated data information system, including water resources and irrigation, in order to monitor developments and produce information on basic resources (water and land)

Enhanced visibility

The States shall seek increased visibility for the irrigated sector through the implementation of this Strategic Framework. They shall entrust CILSS with the responsibility of bringing the advocacy effort to international partners in order to mobilize the technical and financial support needed for the implementation of the Initiative in all its components, particularly the mobilization of funds for developing the irrigated sector in line with the ambitions set out in the Dakar Declaration.

Role of regional organizations

Technical coordination: CILSS' role

CILSS undertakes to use every means at its disposal, including the AGIR and Global Water Coalition for the Sahel platforms to advocate for the Sahel Irrigation Initiative. CILSS shall bring to the Initiative 40 years of

experience in the fields of combating the effects of desertification and food insecurity, water control and natural resource management, support for agricultural commodity markets and land and population issues. In particular, it shall build on its two centers of excellence, the AGRHYMET center and the Sahel Institute, specialized in information generation, vocational training, knowledge management and applied research coordination.

CILSS undertakes to develop excellent services for the benefit of the States. These services should also respond to the multi-faceted commitment needs of sectoral actors as well as the coordination and consolidation of policies and programs.

CILSS undertakes to work closely with other regional bodies, including cross-border basin organizations and regional-level professional organizations, as well as technical partners established in the region to implement these services in an approach focusing on synergy, coherence, complementarity and delegation if relevant. CILSS, however, retains a role of overall coordination of the process at the regional level.

Commitment of Regional Economic Communities

Regional Economic Communities, notably ECOWAS and WAEMU, undertake to support the Initiative in its political aspects so that it contributes effectively to the objectives of the defined regional policies. They are committed to providing the necessary support to CILSS and the beneficiary countries to enhance the visibility and advocacy around the Initiative in order to increase investment for Sahelian and West African producers and populations.

Commitment of regional professional organizations

Regional professional organizations (ROPPA, RAID, etc.) undertake to collaborate with CILSS for the implementation of the services and actions described above. They shall contribute to strengthening the organization and capacities of producer organizations in the countries so that the can assume more effectively their advisory support responsibilities to producers. These organizations will act as liaison for the inclusion and amplification through the Initiative, of strategies and approaches developed by producers, so that they achieve their objectives. They will contribute to amplifying the dissemination of knowledge through their specific knowledge sharing platforms.

Annex 1. Declaration of the High Level Forum on Irrigation

"Building resilience and accelerating growth in the Sahel and West Africa through the revitalization of irrigated agriculture"

DAKAR, 31 OCTOBER, 2013

WE, the representatives of the governments of the six Sahelian countries of Burkina Faso, Mali, Mauritania, Niger, Senegal and Chad, meeting in Dakar on 31 October, 2013 at the invitation of the Government of Senegal, the Inter-State Committee for Drought Control in the Sahel (CILSS) and the World Bank, at the High-Level Forum for the Revitalization of Irrigation in the Sahel countries, alongside the Commissions of the African Union, the Economic Community of West African States (ECOWAS) and the West African Economic and Monetary Union (WAEMU), the United Nations Food and Agricultural Organization (FAO), and in the presence of representatives of international organizations, regional organizations, research, civil society organizations, producer organizations, the private sector and technical and financial partners,

RECALLING:

- The July 2003 African Union Declaration on Agriculture and Food Security in Africa in Maputo in which countries reiterated their commitment to contribute to eradicating hunger and reducing poverty by urgently implementing the Comprehensive Africa Agriculture Development Program (CAADP) and in particular its Pillar 1 on sustainable land management and water control.
- The establishment of the Agricultural Water for Africa Partnership, AgWA in 2010, and of TerrAfrica in 2005 under the umbrella of the African Union, to facilitate the implementation of CAADP Pillar 1,
- The call of African irrigation actors in Ouagadougou in 2007, urging African countries' authorities to recognize the contribution of irrigated agriculture to growth and poverty reduction and to act for its development in a cost-effective and sustainable manner,
- The launching of the activities of the Global Water Coalition for the Sahel by the CILSS Heads of State and Government at their 15th Conference in March 2010 with a view to mobilizing all the skills and resources for water control in the Sahel,

NOTING:

- the food and nutritional vulnerability that has often resulted in the past in acute crises, the predominance of low and unstable incomes, and poverty that weakens a large proportion of the Sahelian population, particularly in rural areas, and increases migration and rural exodus;
- the predominance of rainfed agriculture, affected by the major impact of climate shocks and hazards and the degradation of agricultural land on agricultural production and prices, as well as their amplifying effect on vulnerability;
- the persistent fragility of agricultural value chains and the recurrent marketing difficulties despite an increasing solvent urban demand, particularly for rice and vegetable products;
- the effects of population growth in the Sahel, leading to unsustainable land use on the one hand, and increased demand for agricultural and livestock products on the other hand, making it necessary to increase agricultural productivity;
- The low financial resources allocated to agricultural investment in the Sahel countries, which

contrasts with the large amounts still devoted to food imports,

CONSCIOUS that:

- Irrigated agriculture contributes directly and indirectly to economic growth, the reduction of rural poverty and a balanced development of the territory,
- The potential for agricultural land development through various water management modalities is immense and diversified in the Sahel, from individual or collective water and soil conservation schemes, low-cost individual equipment and village schemes to large-scale public schemes requiring strong financial involvement of the States supported by well-targeted private investments,
- There is substantial room for developing irrigated local production as a substitute for imports, that irrigated rice in the Sahelian valleys is produced at barely higher costs than imported rice and that the effort to reverse this slightly higher cost is within reach,
- The role of the private sector is fundamental to achieving the aim of increasing resilience. The combination of private initiatives and adapted public policies, aiming to make the most effective use of the available natural resources and human potential while respecting the principles of sustainability and social inclusion of all segments of the population. This results in the development of competitive and profitable sectors enabling producers to capitalize from one year to the next for the development of their farm and consequently will contribute to building resilience in the Sahel,

RECOGNIZING that:

- Despite its potential contribution to the agricultural and rural economy of the countries of the region, irrigation currently covers only 2% of the area under cultivation in the Sahel and that less than 20% of the potential is exploited,
- Investment in irrigation in the Sahel has been low over the past 20 years and remains modest despite the recent renewed attention, and a significant proportion of irrigated areas are underutilized,
- Interventions supporting channels of distribution of irrigation equipment adapted to smallholders are often fragmentary and poorly supported over time,
- Some investment operations may have created tensions over the sharing of water and land resources,
- Capacity building and support for agricultural water user associations is insufficient over time,
- Agricultural water policies, strategies and plans that all countries of the Sahel have undertaken require sustained support and increased consultation for their implementation,

DECLARE OUR COMMITMENT to:

- Ensuring that all hydro-agricultural developments are based on appropriate sectoral policies and strategies, which are integrated into a value chain and on a rational and sustainable use of available resources,
- developing a reliable system of land governance, ensuring affordable access to finance for smallholders and investors, providing adequate knowledge and capacity for all stakeholders involved, and building efficient and fair infrastructure and supply chains,
- Implementing a set of diversified investment strategies and programs aimed at harnessing the development potential of a range of possible hydro-agricultural management systems, including: (1) the improvement of rainwater mobilization for agricultural purposes; (2) individual irrigation of high value-added agricultural products; (3) small and medium-scale irrigation managed by village communities for household food needs and local markets; (4) the modernization and expansion of existing large-scale public irrigated schemes, especially rice-growing areas; and (5) commercial irrigation (national or export markets) based on public-private partnerships (PPPs)

and forming part of growth poles,

- Supporting the revitalization of existing large-scale developments so as to improve producer empowerment through capacity building for irrigator associations, on the one hand, and promoting the adoption of low-cost adapted irrigation technologies and systems for smallholders on the other hand,
- Promoting the use of private investors and commercial financing in addition to public investment, by drawing on the various innovative projects that have been successful in Africa and elsewhere in the world and based on viable, fair and equitable partnerships in which, previously organized farmers (including women and young people), are involved in decisions made on the basis of shared information,
- Conducting sustained capacity building at the regional, national and local levels for each key actor category in the sector through: (a) the establishment or strengthening of agricultural water training centers, particularly regional or national centers of excellence; (b) collaboration with the private sector on expertise in the implementation of irrigation projects; (c) the implementation of ongoing capacity building programs for farmers; and (d) support for the training and retraining of private operators interested in investing in the sector,
- Implementing the principles of Integrated Water Resources Management in the framework of international river basins and organizations in charge of their management, and seizing the opportunity of cross-border collaboration established to foster the development of agricultural water management interventions,
- Urging strong and ongoing efforts to further facilitate regional trade, sustainable land management and related infrastructural developments, which are prerequisites for successful operations,

CALL ON Sahelian countries' governments assisted by their development partners and the private sector adhering to the terms of this declaration, to:

- Significantly increase investments in agricultural water projects from 400,000 hectares today to 1,000,000 hectares by 2020, at a total estimated cost of more than US $ 7 billion,
- Integrate this objective into coherent programs expediting the implementation of sectoral policies, institutional reforms, the legal framework and organizational arrangements relating to agricultural water and rural land management, irrigated production and, where necessary, to the agricultural sectors concerned, following negotiated processes,
- Ensure transparency and equity in the distribution of costs, the operation and maintenance of irrigation systems, while strengthening the capacities of farmer organizations that are involved in their management, on the basis of a suitable regulatory framework;
- Intensify support for regional initiatives aimed at improving and expanding irrigation in the Sahel and West Africa, such as those related to the implementation of CAADP Pillar 1, the Agricultural Water for Africa Partnership, AgWA, under the aegis of the African Union, and the Global Water Coalition for the Sahel.

Annex 2. List of the Task Force's Members

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