

**Senegal: Boundoum irrigation, delta drainage system**

**Ex post evaluation**

<b>OECD sector</b>	31140 / Agricultural water resources			
<b>BMZ project ID</b>	1a 1988 66 568 Boundoum irrigation (Investment) 1b 1988 70 347 Boundoum irrigation (Federal funds) 2a 1994 65 501 Delta drainage system (Investment) 2b 1994 70 394 Delta drainage system (Federal funds)			
<b>Project-executing agency</b>	(All) SAED			
<b>Consultant</b>	(1a, Perimeter) BDPA-SCETAGRI, Paris (1b, Drinking water component) GITEC, Düsseldorf (2a) Lahmeyer, SOGREAH – SETICO			
<b>Year of ex-post evaluation</b>	<b>2005</b>			
	<b>Project appraisal (planned)</b>		<b>Ex post evaluation (actual)</b>	
<b>Start of implementation</b>	1a	01/1989	1a	01/1989
	1b	01/1989	1b	05/1991
	2a	03/2000*	2a	03/2000
	2b	07/2001	2b	None
<b>Period of implementation</b>	1a	72 months	1a	110 months
	1b	72 months	1b	83 months
	2a	36 months	2a	16 months
	2b	9 months	2b	None
<b>Commissioning*</b>	1a	Progressively from 06/91	1a	Progressively from 08/91
	2a	08/1998	2a	07/2001
<b>Total cost</b>	1a	32.0	26.5	
	1b	1.28	1a	2a 8.9
	2a	9.6*	2b	0.0
	2b	0.1*		
<b>Counterpart contribution</b>	1a	0.0	1a	0.0
	1b	2a 0.0	1b	0.0
	2b	0.0	2b	0.0
			2b	0.0
<b>Financing, of which Financial Cooperation (FC) funds</b>	1	19.2**	1	19.2***
	1a	1.28	1a	1.28
	2	9.6	2	8.9
	2a	0.1*	2a	0.0****
<b>Other institutions/donors involved</b>	1a	World Bank	1a	World Bank
	2b	None	2b	None
<b>Performance rating</b>	4			
• <b>Significance / relevance</b>	3			
• <b>Effectiveness</b>	4			
• <b>Efficiency</b>	5			

\* According to the supplementary appraisal report dated 15 July 1999.

\*\* An additional EUR 10.8 million from the World Bank under a parallel financing arrangement.

\*\* EUR 7.3 million from the World Bank.

\*\*\*\* The remaining EUR 34K in accompanying measure funds will be used for other projects.

### **Brief description, overall objective and project objectives with indicators**

Project 1 covers the rehabilitation and extension of the Boundoum perimeter. As the Senegalese government did not fulfil its obligations to ensure the appropriate removal of drainage water as part of the project execution, Project 2 (delta drainage system) was designed.

(Project 1) The objective of the project, which is executed under parallel financing with the World Bank, was to repair and extend the Boundoum irrigation perimeter, originally planned to cover a surface area of 3,100 ha, which was to be used mainly to grow rice. The project covered the renovation and extension of the pumping stations and the irrigation and drainage network. A further component, financed solely from FC funds, involved the construction of village drinking water supply systems and further measures to improve the social infrastructure were planned. As part of the accompanying measure, advice was given to the farmers organisations, the water user committees for the drinking water component and the regional division of the project executing agency, the Société Nationale d'aménagement des Terres du Delta et des Vallées du Flueve Sénégal et de la Falémé (SAED).

The overall objective is to raise income and increase employment for people leaving near the Boundoum perimeter.

Indicators for the achievement of the overall objective are the number of farming families working in the perimeter and their income from farming.

The project objectives are to increase rice production by rehabilitating and extending the area under cultivation, to increase cultivation intensity, and to increase and stabilise the yields per hectare.

Indicators of the achievement of the project objective are: (a) The use of 3,100 ha of rice irrigation land with a cultivation intensity of 1.6 harvests per annum in Year 6 (1995). (b) An improvement and stabilisation of the yields per hectare at 4.7t/ha paddy yields per campaign in Year 6. If both objectives are met, 7.5 t/ha of rice per annum will be harvested.

The target group comprises the rice growers in the area around the Boundoum perimeter.

(Project 2) The project aimed at ensuring the environmentally friendly removal of drainage water from the Boundoum perimeter, which is used for growing rice. This became necessary when the construction of a main drainage channel for the entire Senegalese river delta, which was originally planned as part of the Boundoum project, failed to materialise. In its revised form (see below), the project covered the construction of the first section of a main drainage channel extending over approx 16 km, embankments around natural basins covering approx 2,000 ha to allow the drainage water to evaporate, and a pumping station. When the project appraisal was carried out, it was assumed that as soon as the drainage capacity of the first extension stage had been fully exploited and there was evidence of the need to link further perimeters, the originally planned design (extension of the length of the entire drainage channel to 69 km and establishing a pumping station near Diama) would be implemented.

Overall objective: To preserve the habitat and the development potential of the Senegal delta and to preserve areas of local and international significance that are in need of protection.

Indicator of the achievement of the overall objective: Not specified.

Project objective: To ensure agricultural sustainability through environmentally friendly drainage of wastewater from the irrigation areas.

Indicator of the achievement of the project objective: Yield of the irrigated rice growing areas connected to the delta drainage system (large perimeter > 7.5 t/ha per annum, Périmètre Irrigué Villageois (irrigated village perimeter) > 4.5 t/ha per annum). Appropriate use and maintenance

of the delta drainage system by the Boundoum perimeter and reduction of the salt content in the Gorom Aval to its natural level.

The group directly targeted by the first extension phase comprises the approx 1,650 families which work the Boundoum perimeter.

### **Programme design / major deviations from the original programme planning and their main causes**

(Project 1a) A major design change was that the Senegalese government did not meet the agreement to ensure environmentally friendly removal of drainage water from the perimeter by building a main drainage channel (Grand Emissaire du Delta) in parallel to the project execution. Consequently, drainage water from the perimeter was first channelled into the Gorom, the first receiving watercourse. This led to considerable environmental pollution as the people living further downstream use water from the Gorom for drinking and irrigation. There were also fears that the drainage water would pollute the Djoudi bird sanctuary approx 20 km away. To reduce the environmental impacts, the FC delta drainage system project was then implemented.

With regard to the perimeter component, the extension/renovation mainly went according to plan. A greater irrigation area than originally planned was rehabilitated/developed (actual area: 3,362 ha; planned area: 3,100 ha). Technical changes concern the rehabilitation of Diawar pumping station, which meant that the new Boundoum Barrage pumping station did not need to be built. As part of the accompanying measure, SAED was given support in the planning and maintenance measures on the perimeter (for example, guidance in estimating size and cost) although the impact on SAED was minimal.

The actual water supply component far exceeded original plans (actual cost: approx EUR 3.25 million; planned cost: EUR 0.87 million) and now affects seven villages (planned: 3); care was taken to ensure that the villages on the perimeter were treated equally. In addition, the high salt content made it impossible to simply draw on groundwater and, as a result, supply had to be ensured by extracting and treating river water, which was far more expensive.

The delay in executing the perimeter component was partly attributable to the fact that the technical design needed to be adjusted and the construction period extended. With regard to the water supply component there were delays in the execution of vital preliminary surveys, which led to the start of construction being postponed. Problems at a company engaged for the construction resulted in the execution period being extended. As part of the accompanying measure, an animation campaign was carried out to support the development of organisational structures which operate the water supply independently of SAED.

(Project 2) The original design of the delta drainage system project (1994) assumed a marked increase in the irrigation areas connected to the perimeter (10,300 ha) as a distinct increase in the perimeters run by private investors was forecast. In order to reduce the environmental damage connected with the previous removal of drainage water from the Boundoum perimeter, the original project design consisted of channelling the drainage water from the existing and future perimeters in the area served by the delta drainage system into the Senegal River below the Diama dam (designed to prevent salt water intrusion). The plan was to construct two pumping stations and a diversion channel (45 km) and to develop the existing Djeuss delta distributory (25.4 km) so that it could receive drainage water. The perimeter irrigation and drainage water in the area served by the delta drainage system would thus have flown into separate watercourses. However, contrary to the original assumptions, agricultural development in the Senegal Valley stagnated. The supplementary appraisal report (1999) assumed that the Boundoum perimeter would be the primary user of the delta drainage system. The design of the delta drainage system was adjusted to the change in the underlying conditions. Instead of diverting the drainage water, which would have been more technically and financially demanding, the new concept consisted of channelling the drainage water into natural basins that already existed; it could then be left to evaporate. The measures required to achieve this included the construction of a pumping station (Galea), a drainage channel (approx 20 km) and embankments around the basins in Boundoum (400 ha) and Krankaye (1,600 ha). As well as draining the Boundoum perimeter, the system is also intended to drain private perimeters on the

Lampsar Aval (approx 1,200 ha) and up to 1,200 ha of further private perimeters. In the new design the project causes environmental damage to the evaporation basins owing to the increase in salt levels. However, as the basins have so far not been used very much – only extensive pasture farming – this has been judged acceptable for the time being. The project has been carried out largely as in the supplementary appraisal report. So far, however, only the irrigation areas in the Boundoum perimeter have been connected to the delta drainage system. An accompanying measure originally planned to develop a system for monitoring the quality of the water was not implemented owing to a lack of interest on the part of SAED.

In neither project was there any indication that funds were misused. The unused funds that were originally intended for the accompanying measures in the delta drainage system project (EUR 34K) will be used for other projects. KfW will provide separate information on this matter.

### **Key results of the impact analysis and performance rating**

Boundoum drinking water component: Use of the water supply facilities that were set up is far below average. At approx 8 litres/inhabitant/day, average consumption is well below the level of 20 litres/inhabitant/day forecast at the time of the appraisal as the inhabitants (approx 15,500) are still drawing the water they need for washing and operational use from the irrigation channels. The average tariff in the seven water supply systems is roughly FCFA 500 per m<sup>3</sup>. At the current rate of consumption, drinking water costs account for roughly 5% of available income. The average collection rate is 74%. Based on full costing, cost coverage is between 10% and 37%. Operating costs are covered fully in one system only and in the other six systems 40-80% of the operating costs are covered. The systems are in good technical working order.

Irrigation component: The farmers mainly use the 3,362 ha of irrigation areas to grow rice, but only in the main growing season. Since 2000 no rice has been grown in the low season. One of the main reasons for this is there are not enough agricultural loans available. Consequently, the farmers do not have the funds they need at the right time to acquire the inputs they need for a second cultivation period. The yields are around 6 t/ha. The income determined on the basis of a model calculation is around FCFA 825,000 (without project: around FCFA 155,000).

The farmers pay an irrigation fee of FCFA 67,000 per hectare in the main cultivation period, which covers roughly 85% of the cost of maintaining the perimeter. There has been a marked increase in the collection rate since 2002 and it is currently more than 90%. SAED is responsible for operating, maintaining and repairing the general irrigation infrastructure, while the farmers organisations in the UNION are in charge of the operating, maintaining and repairing the system in the perimeters. However, a study carried out in 2002 showed that the UNION was not fulfilling its contractually agreed perimeter management duties. This was the result of problems in the organisation and the disorganised state of the UNION finances. Since then SAED has taken a greater hand in managing the perimeter. At the moment the technical state of the irrigation system is still largely inadequate and its ability to continue to function depends on the required maintenance measures being implemented consistently.

Delta drainage system: SAED is responsible for operating the general drainage infrastructure. To finance the maintenance of the drainage systems the farmers pay an annual drainage fee of FCFA 16,000. The Gaéla drainage pumping station is in working order. Operational weaknesses are mainly that there are no clear rules for using the pumps and no accounts are kept of drainage volumes. There are clear weak points along the main drainage channel. The water level in the channel is currently too high and the flow is mainly stagnating (planned flow speed: 0.5 m/s). This is indicative of technical or operational (removal of weeds) defects, which result in the main drainage channel becoming an unplanned part of the overall evaporation and infiltration area. This leads to an increase in the medium to longer-term risk of unplanned salinisation outside the infiltration basins.

The delta drainage system project shows no direct impact on income and is better seen as a necessary functional and ecological extension of the Boundoum irrigation project. The delta drainage system costs are thus included in the calculation of the economic rate of return. As only the Boundoum perimeter areas are connected to the delta drainage system, the costs are

only set against the additional yields from the Boundoum irrigation areas. Corresponding calculations yield a negative economic rate of return (-7%).

We rate the developmental effectiveness of the two projects as follows:

- The objectives of the irrigation component of the Boundoum project have been more than achieved in terms of the yield per hectare per harvest (planned: 4.7 t/ha; actual: 6.0 t/ha). However, as the intended increase in cultivation intensity was clearly not achieved (planned: 1.6; actual: 1.0), at 6 t/ha the overall yield (product of the yield per hectare per harvest and the cultivation intensity per annum) is far less than planned (7.5 t/ha). In the drinking water component, which accounts for just under 20% of the FC funds used, the main sectoral success criterion of covering operational costs was not met. By and large, the objectives of the delta drainage system project have not been achieved. Apart from the large Boundoum perimeter, no other irrigation areas have been connected to the delta drainage system. Only the Boundoum perimeter areas have been connected to the delta drainage system. The actual overall yield fell well below the targeted yield set for the delta drainage system (actual: 6.0 t/ha; planned: 7.5 t/ha per annum). The main reason is that cultivation was not intensified. We rate the effectiveness of the two projects as insufficient (sub-rating: rating 4).
- The assumptions that, as a result of extending the irrigation areas, the Boundoum project would lead to a marked increase in agricultural production and consequently raise income were essentially plausible. This also applies to the assumptions made about the impact of the delta drainage system project, namely that the construction of a drainage system would avoid negative environmental impacts arising from the fact that the drainage water from the Boundoum perimeter was previously channelled into the tributary of the Senegal River from where the people living further downstream drew their drinking and irrigation water (relevance). The impact of the Boundoum project is therefore limited as the originally planned intensity of use of the irrigation areas was not achieved. The delta drainage system project led to a slight improvement in conditions because the drainage water from the Boundoum perimeter is no longer channelled to tributaries of the Senegal River. However, salinisation of the 2,000 ha of evaporation basins is increasing. We rate the relevance/significance of the two projects as just sufficient (sub-rating: rating 3).
- The specific investment costs of rehabilitating the perimeter or of constructing the drainage system were appropriate (production efficiency). As this is a productive agricultural project, a negative economic rate of return (-7%) is not acceptable (allocation efficiency). We judge the efficiency of the two projects to be clearly unsatisfactory (rating 5).

We rate the overall developmental effectiveness of the Boundoum and delta drainage system projects as slightly insufficient (rating 4).

The Boundoum project aimed for direct poverty reduction. Account is taken of the self-help aspect by the fact that the target group is organised in user groups. Taken alone, the delta drainage system project demonstrates no direct impact on income but only an indirect impact. By setting up user groups, to which sizeable parts of the operational responsibility for the perimeter have been transferred, the Boundoum project contributes to enhancing participation. As SAED is responsible for operating the general drainage structure, the delta drainage system project does not aim to achieve a direct increase in participation. An improvement in gender equality was not an explicit Boundoum project objective. However, the project shows potential for improving the situation with regard to gender equality. There were no measures that were expressly geared to this objective and therefore no corresponding impact was observed. By contrast, the delta drainage system displays no direct potential for improving gender impacts and there were no corresponding effects. The Boundoum project did not pursue the goal of improving the environment. However, it had an unacceptably high negative impact on the environment owing to the unacceptable drainage situation in the perimeter after operation

began (drainage water channelled to the tributary of the Senegal River used for drinking and irrigation water). The delta drainage system project explicitly aimed at improving the environmental conditions. As a result of the above-mentioned difficulties with the main drainage channel, however, the improvement to the environmental situation might be less than originally planned.

### Conclusions and recommendations

Larger irrigation perimeters should only be rehabilitated if a satisfactory drainage system is provided at the same time. While measures to extend irrigation are relatively popular in the beneficiary countries because of the directly perceivable positive impact on yield, this is frequently not the case for projects which focus on drainage as the costs are not offset by directly perceivable yields. Appropriate account should be taken of this when determining the financing shares to be borne by the recipient country and FC.

In order to achieve the full potential of irrigation perimeters in terms of increasing cultivation intensity, the farming enterprises also need secure and sufficient liquidity. Socio-economic analyses in the planning stage should include checking whether these conditions are met in the initial situation. Otherwise the project design should be supplemented by complementary measures to improve marketing and credit supply.

In the case of water supply projects in regions which are characterised by a large degree of water availability, a critical examination needs to be made of the target group's willingness and ability to pay as part of more intensive socio-economic surveys at the project appraisal stage. If the forecast long-term operating costs are higher than the willingness/ability to pay, the location is generally not suitable for a project of this kind, i.e. without long-term subsidies.

In particular, large irrigation perimeters which require technically complex systems (e.g. central pumping stations) mean that the executing institutions in charge need to have sufficient sanctioning options vis-à-vis the users if the latter fail to comply with the agreements made with the executing agency regarding mutual rights and duties.

### Assessment criteria

Developmentally successful: Ratings 1 to 3	
Rating 1	Sehr gute oder gute entwicklungspolitische Wirksamkeit
Rating 2	Satisfactory developmental efficacy
Rating 3	Overall sufficient degree of developmental efficacy
Developmental failures: Ratings 4 to 6	
Rating 4	Overall slightly insufficient degree of developmental efficacy
Rating 5	Clearly insufficient degree of developmental efficacy
Rating 6	The project is a total failure.

### Criteria for the evaluation of project success

The evaluation of the "developmental efficacy" of a project and its classification during the ex-post evaluation into one of the various levels of success described in more detail below concentrate on the following fundamental questions:

- Have the **project objectives** been achieved to a sufficient degree (project **effectiveness**)?
- Does the programme generate sufficient **significant developmental effects** (programme **relevance** and **significance** measured in terms of the achievement of the overall developmental policy objective defined beforehand and its effects in political, institutional, socio-economic and socio-cultural as well as ecological terms)?

- Are the **funds/expenses** that were and are being employed/incurred **appropriate** with a view to achieving the objectives and how can the programme's microeconomic and macroeconomic impact be measured (**efficiency** of the programme design)?
- To the extent that undesired (**side**) **effects** occur, can these be tolerated?

We do not treat **sustainability**, a key aspect to consider when a project is evaluated, as a separate evaluation category, but rather as an element common to all four fundamental questions on project success. A project is sustainable if the project-executing agency and/or the target group are able to continue to use the project facilities that have been built for a period of time that is, overall, adequate in economic terms, or to carry on with the project activities independently and generate positive results after the financial, organisational and/or technical support has come to an end.