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DEVELOPMENT OF THE SENEGAL RIVER VALLEY

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DEVELOPMENT OF THE SENEGAL RIVER VALLEY

I. THE REGION

The river Senegal is either 1 600 km or 1 800 km long, depending which geography book you refer to. It is much shorter than the Nile (6 500 km), the Zaire (4 650 km) or the Niger (4 200 km). But because of the expanse of its catchment area (289 000 km^2), the nature of its flow (24 000 million cubic metres per year on average, but very irregular), the four states through which it passes (Guinea, Mali, Mauritania and Senegal) and the 1 600 000 people that live along its banks, an exceptional amount of interest has been shown in it for over a century and half now. According to officials of the Organization for the Development of the Senegal River (OMVS), harnessing the river would lead to nothing short of an agrarian revolution and transform the region into the "bread basket of the Sahel".

An age-old dream

The idea of harnessing the river to improve and diversify the rural economy of the valley dates back in fact to 1822. It was in that year that the botanist, Richard, noted two of the region's characteristics:

- in many places a high incidence of fertile soil on which a variety of crops could be grown, but unevenly distributed and handicapped by the serious problem of salinity in certain delta areas;

- considerable hydro potential, but exceptionally difficult to exploit and develop in any consistent fashion.

Richard set up an experimental plot beside the river, on a site which was later to be called Richard Toll, where the Senegal joins its offflow, the Taouey, Which flows on to Lake Guiers. At this point, freshwater supplies are available over a long period and particularly during the dry season, when the waters drain down from the lake.

The aim of the experimental plot was to enable new plants to be introduced into the region and distributed among the peasants in the valley, who would then have marketed the crops, and to disseminate more effective agricultural techniques than those used in floodplain farming such as, for example, balance-beam wells for irrigation. The plot suffered extensive damage in 1931 when the river was at high water and the experiment was abandoned. Over the years, numerous missions were sent to the region. Little by little it became apparent that integrated development was the only way, and this meant carrying out vast engineering and other works all at once. It was this "all or nothing" attitude that was to prevail in the region with the result that choices were always being put off until later.

Studies on the first large-scale project for the overall development of the delta were started in 1947 by Peltier and Delisle. The war had made the problem of food supplies for Senegal even more critical - 60 000 t of rice had had to be imported in 1940. Peltier and Delisle worked out a project that was to enable 50 000 ha in the delta to be planted with rice. It got only as far as the establishment of the Richard Toll rice-fields (6 000 ha), on which rice was grown to start with but which was converted in 1972 to a sugar plantation managed by the private company "Compagnie sucrière sénégalaise".

Richard Toll was blessed with an ideal site, with the natural reservoir of Lake Guiers, but it was to suffer frequently from the inadequate flood of the river and the fact that the lake did not always fill up completely. From 1960 onwards development projects were reorientated away from the Richard Toll experiment towards development at grass-roots level, on individual farms. Options changed. The idea was to reconcile peasant labour with the need for mechanization, for technical reasons. This marked the start of the development of irrigated areas - small village areas and large-scale developments - which preceded the big OMVS integrated programme.

1. CHARACTERISTICS OF THE RIVER SENEGAL

The river Senegal acquires its name at Bafoulabé, where two rivers with sources in Guinea meet, the Bafing (meaning "black river" in the local tongue), which flows down from the Fouta Djalon 800 m above sea level, and the Bakoye (white river), which springs out of the western slopes of the hills at an altitude of 750 m above the upper Niger valley. There are a number of small tributaries from the north in the upper reaches - the Kétiou, the Kolinbiné and the Karakoro - but it is from the south that the major tributary flows into the Senegal river, at the junction of the Malian, Senegalese and Mauritanian borders. This tributary is a large river, also from Guinea, called the Falémé. When it reaches Kayes (in Mali), still 920 km from the sea, the river Senegal is only 40 m above sea level.

Below Bakel, a township in Mali 810 km from the estuary on the edge of the upper reaches and the valley proper, the landscape opens out rapidly and the valley widens to twenty kilometres in places. By the time it reaches Bakel the river has received all the extra water it is going to get from its tributaries. The Gorgol river, which joins it from Mauritania, makes a very small and irregular contribution.

Bakel is the township generally chosen for working out the average flow rate for the river Senegal. It is put at 750 m^3/sec, but this figure does not mean very much at the moment given the capricious nature of the river. One of the OMVS's essential aims is precisely to regulate the flow of the river. Up to now it has always varied greatly from one year to the next and from one part of the year to the next. The average flow rate for 1924 was 1 241 m^3/sec whereas for 1972 it was 264 m^3/sec.
The flow rate over the year depends on the rainfall. Between May and November in the Sahelian climatic zone the rainfall is more or less abundant depending on the region.

Rainfall in the upper catchment area, particularly in the Fouta Djalon, where the Bafing has its source, totals some 2 000 mm.
At Kayes it is barely 700 mm.
At Bakel it never goes above 680-685 mm.
At Matam it falls to 525 mm.
At Rosso it is as low as 300-305 mm.
At Saint Louis, with help from the trade winds off the sea, rainfall rises to 350-355 mm.

Hence annual rainfall gradually decreases as one moves from east to west, and particularly from the southern border with Guinea towards north-eastern Senegal, which is in fact the edge of the Sahara desert.

The peasants living in the upper catchment area, above Bakel, where annual rainfall varies between 685 mm and 2 000 mm, can make good use of irrigation in many instances to improve their crops. In a normal year they can produce excellent rain-fed crops, unlike the farmers living in the middle or lower reaches or in the delta area, who have to make do with between 400 mm and 500 mm of rain per year, or less. In these areas, not only is rainfall scarce between July and October but the evaporation rate is very high. Around Dagana the sun's rays beat down for between 3 000 and 3 300 hours per year and the daytime temperature in the delta is 35-36°C.

The river is absolutely essential for the peasants living in the middle or lower valley and in the delta to be able to grow crops. But they are often deprived of its benefits, for the following three reasons:

1. in years when the rainfall is very high the river floods and, since there are no adequate dykes, serious damage is caused to the fields;
2. when rainfall is below average or low, the Senegal does not overflow sufficiently for the farmers living along its banks to be able to grow their traditional floodplain crops. In any case, at the height of the dry season - towards May/June - the water is passing through Bakel at the rate of only 9 or 10 m^3/sec as opposed to 3 320 m^3/sec on average in September;
3. at that time (May/June) the waters of the river near the estuary are practically at sea level and there is nothing to stop salt water from invading the delta at high tide. This "salty invasion" can reach as high as Dagana, 200 km from the estuary, bringing with it a trail of damage. It means that the river water cannot be used for agriculture and obliges those living along the river banks, including sometimes the inhabitants of Saint Louis, to consume salt water.

2. THE PEOPLE

The Senegal river basin, Guinea excluded, covers 258 000 km^2 or 10% of the total area of the three member states of the OMVS[1].

[1] Mali: 1 204 000 km^2 -Mauritania: 1 170 000 km^2 -Senegal: 197 000 km^2

However, virtually the whole of Mauritania and over 90% of Mali consist of desert and so the 258 000 km^2 in question can be considered to represent at least 35% of the useable land.

The 1 600 000 inhabitants of the basin account for 14% of the total population of the three states. The population is rural for the most part (1 300 000), with an urban minority distributed between Saint Louis and Kayes and the townships such as Rosso, Kaédi, Boghé, Dagana, Matam, Bakel or Podor (i.e. 300 000 people) but the drift to the towns is speeding up.

There are large concentrations of population in the alluvial plains around Bakel, at Richard Toll and at the top of the delta, while the rest of the basin, particularly the middle reaches, is sparsely populated.

The delta is virtually uninhabited, apart from Saint Louis. This is a typical feature of the human geography of the Senegal river basin. The reasons for it are the salinity of the soil and historical events.

The population of the Senegal river basin consists of Wolof (delta), Toucouleur (middle reaches) - by far the largest ethnic group, estimated at 300 000 - Peulh (found in small groups from the delta up to Bakel) and black Moors or Hartani, many of them descendents of half-caste (white Moor and negro) slaves (white Moors themselves are quite rare in the valley).

The tribes to be found in the upper basin are essentially the Mandingo, subdivided into numerous groups including the Soninké or Sarakollé, who have settled along the river below Bakel, then the Bambara, upstream from Bakel, and further upstream still, along the Falémé, Bakoye and Bafing rivers, the Malinké.

Of the total population Senegal has 58.3%, Mauritania has 37.3% and Mali has 4.4%, distributed over the following areas:

Senegal:

Matam	171 000
Podor	151 300
Dagana	122 000
Bakel	34 500

Mauritania:

Kaédi-Maghama	92 500
Boghé-Mbagne	91 400
Rosso-Keur Massène	89 200
Selibaby	33 500

Mali:

Ambidédi-Diamour	35 700

All these people have slightly different forms of economie activity. All practise stockfarming in various forms; they barely grow enough food to live on.

The Toucouleur are numerous in Senegal's towns and it is estimated that over 100 000 of them have settled in the Cap Vert peninsula.

The Sarakollé tend to migrate to France, providing 70% of its Black African workers, and to other centres of economic activity in francophone Africa - Abidjan in the west and Gabon and Zaire in central Africa. An emigration rate of this magnitude deprives the villages of a large proportion of the work force and of their most dynamic and broadminded elements. This is a clear demonstration that the traditional economy of the valley can no longer cope with the needs of the population.

3. SOIL CHARACTERISTICS

The nature of the soil wasted by the river Senegal varies from one area to another. In the south-western region of Mali, there are relatively friable soils produced by erosion. Further north, in the Kayes area, ferruginous and lateritic soil is found along with tropical brown soil. Only rather small areas of both types of land can be irrigated. In the middle and lower reaches and, generally speaking, from Bakel onwards, there are two different types of land along the riverside: the "diéri" and the "walo".

The "diéri" (river-bank crops grown)
The rainfall from June to October enables crops to be grown during the winter season on the "diéri" on the slopes of the valley. Since this type of land is so plentiful, the rules governing tenure are very lax. Mainly millet is grown there. Although it lies next to the river bed, the "diéri" is never reached by the high water and therefore depends on rainfall unless appropriate devices are installed to irrigate it artificially.

The "walo" (floodplain crops grown)
This land is situated on the major bed of the river, and is generally flooded from June to November. As soon as the high water goes down, crops are planted on this land, so that its charactéristics are altogether different from those of the "diéri". The term "walo" covers a number of different kinds of land:

i. The "falo", comprising the banks of the river. This is the land which is most liberally and most regularly enriched with silt. It is used to grow crops in the dry season (maize, niebe, beref, tomatoes, sweet potatoes) but covers only a very small area. Falo land is greatly sought after, particularly the land on the banks of the meanders. As it is planted first, it has the advantage of yielding crops very early.

ii. The "hollaldé" makes up the bulk of the land cultivated after the flood water has receded. It is found in the large depressions on either side of the river and is flooded from downstream with varying regularity depending on how high it is. It is very resistant and is made up of 40% sand and 60% clay. Mainly sorghum is grown there, in rotation with niebe and beref.

iii. The "fondé" is the highest land. It comprises the raised strips on the bank, containing 70% sand and 30% clay. It is flooded only by very high water. It is easy to work, soft, fertile and versatile, and is cultivated first by the people living on the river banks: its softness is a serious drawback, however, in that it is very permeable and not suited to crops which require

II. GENERAL OBJECTIVES OF THE OMVS

The OMVS programme comprises the building of the two dams at Diama and Manantali, the development of 375 000 ha of irrigated agricultural land which would gradually be brought into use over a period estimated at between 40 and 100 years, infrastructure to make the river navigable right up to Kayes, electricity generation and the development of various industries. The OMVS project is an example of regional cooperation between the three countries concerned, each of which will derive benefits from its execution.

Senegal and Mauritania are particularly interested in the irrigation aspect (64% of the irrigable land is in Senegal and 32% in Mauritania), while Mali is more immediately concerned with navigation and electricity production. The project also has the advantage of drawing a large volume of resources into these three countries, mainly from Arab countries, which would not have been mobilized without this project.

The riparian states, with the exception of Guinea which is not part of the OMVS, are relying on the project to solve their food problem, which over the years has assumed increasingly disastrous proportions.

Senegal at present imports 400 000 t of rice (from Thailand and Pakistan) and 80 000 t of wheat a year. Mauritania, despite its sparse population, last year bought 60 000 t of rice and 40 000 t of wheat on the world market. Despite enormous potential, Mali is burdened with a chronic grains shortfall estimated at 160 000 t in 1980. Furthermore, as a very large country much of which is desert, its road network is far from adequate in length, quality or density. The development of navigation on the river could help, about with the existing railway, to open up the country.

Mauritania, which is also almost entirely desert, extends over huge uninhabited expanses of sand. The sides of the Saharan djebels in the hinterland contain large metal ore reserves but they have no water supplies.

1. AGRICULTURE: NUMBER ONE TARGET FOR THE OMVS

Agriculture represents the economic cornerstone of the OMVS. The sums to be invested in it are almost ten times those earmarked for the two dams.

There are two stages to the OMVS project:

Stage 1: 1981-1990 comprising the building of the two dams, Diama and Manantali;

Stage 2: 1981-2030 comprising the development of agriculture and the supply of farming equipment, equipment for the Manantali power plant and possibly investment in navigation.

The economic impact of the project will depend on the results obtained from agriculture, notably increased yields and expansion of the irrigated areas. The most marked effects are indeed expected in arable and stock-farming.

The last disastrous drought in the Sahel and the ensuing famine were a very important factor in speeding up decision -making on the project. Full realization of the agricultural potential will probably not be achieved until 40 years after completion of the two dams, or even until 100 years after completion according to some calculations.

Current situation

The area's economy is traditionally based on floodplain crops grewn on the land which is prone to flooding in the middle and lower reaches ef the valley from Bakel down to the delta (some 120 000 ha of "wale" crops) and also, to a lesser degree, on river crops grown during the rainy season on the land alongside the major bed above the highest water level (some 80 000 ha of "dieri").

The floodplain crops, and especially sorghum, are entirely dependent on the river, since they rely on the water which acoumulates over the large areas constituting the major bed following the floeds of August and September. It is obvious that if high water can be released regularly in controlled doses, if floodplain crops can be grown more efficiently and if irrigation can be used wherever possible, this will increase production considerably, first of all in quantity, beoause the areas cultivated will be extended, secondly because double cropping will become the norm, and lastly because appropriate ways and means can be used to improve yields.

The economic impact sought will depend on a far-reaching change in the method of agricultural production and consequently on the social structure of the population of the Senegal valley.

Aims

1. Transition from one of the most unreliable agrioultural areas in the world to almost perfectly controlled agricultural produotion.

Until now agricultural production on the banks of the river Senegal, which depends mainly on the flood waters of the river, is the most severely threatened and most unstable in the world. Nowhere else are there variations from 1 to 10, from one year to the next, in the areas cultivated and planted with seed. Nowhere else is there such a disparity between the areas planted and the areas which actually yield crops. The inhabitants of the valley are just as likely to have very plentiful harvests and marketable surpluses in a good year as they are to suffer the severe shortfalls which have already caused hardship and famine in the past. Although the valley has for a long time been densely populated compared with the other regions of the Sahel, floodplain crops combined with the unpredictable yield from river-bank crops have never provided the population with any long-term food security.

2. Introduction of new crops into the region

Rice: it is practically the only region in West Africa where rice is a new crop.

Temperate cereals: wheat and barley. Since there will be a monitored water supply in the dry season, these cereals would replace crops grown in the warm season, such as millet and in particular sorghum, which

require much less water.

Tomatoes and temperate vegetables: they would replace traditionally grown vegetables which require much less water, such as béref.

3. Transition from scattered, unstable and almost itinerant crop production in line with the fluctuations of the river and its floods to a more collective, stable and permanent type of agriculture concentrated around a few centres.

The population, which is naturally scattered and divided into small units, should gradually not only be redistributed but also frequently moved to cultivate new areas.

4. Transition from standard extensive agriculture to highly intensive agriculture

The transition to controlled agriculture should enable cereal yields to be increased fifty fold. These new conditions will make the peasant farmers abandon the practice of producing for their own consumption and grow more and more marketable cash crops in order to improve their life-style. Even if the improvement is not immediate, the incomes obtained by the peasants concerned will gradually rise, and they should attain a degree of comfort hitherto out of their reach and participate in the development of their country, to which they have not previously contributed. This should cut down the drift to the towns.

A period of transition

The OMVS programme provides for the maintenance for at least ten years of "artificial floods" in the river.
Consequently, there will be a transitional period during which floodplain crops and a reorganized form of the traditional system will be maintained for a number of years.

In the lower parts where the river, during its annual spate, overflows far beyond its minor bed for a long period, this flooding could be artificially stabilized in an initial stage and floodplain crops grown under excellent conditions. The use of irrigation will subsequently enable the water to be harnessed completely and permit a number of crops per year.

By around 1991, the system of "artificial floods" could be stopped. As irrigated areas were created, a certain proportion of "walo" land would disappear through transformation, but actual total control, making sufficient quantities of water available for year-round irrigation everywhere would of course depend on regulation of the river and the building of the two dams. A number of areas irrigated by pumping have already been developed by:

SAED: société d'aménagement et d'exploitation des terres du delta (Senegal).

CSS: Compagnie sucrière Sénégalaise (Senegal).

SOCAS: Société de conserves alimentaires du Sénégal (Senegal).

SONADER: Société nationale de développement rural (Mauritania).

OVSTM: opération vallée du Sénégal, TEREKOLE, Magui (Mali).

These irrigated areas amount at present to 28 805 ha, broken down as follows:

Senegal: 23 230 ha
Mauritania: 5 305 ha
Mali: 270 ha

The areas can be divided into village areas and large areas:

The village areas range from 15 and 20 ha to a maximum of 100 ha. They are generally situated on "fondé" land, on thiok strips of river bank. They have only light infrastructure and are equipped with a motor-pump unit, small retaining embankments, and levelled plots. They require considerable work on the part of the farmers and are near the villages.

The large areas extend over several thousand hectares. They comprise submerged land and land which is above water, with soil ranging from light to heavy ("fondé", "faux hollaldé", "hollaldé"). They have heavy primary infrastructure. The Work is carried out by direct labour (such as the SAED in Senegal). They are sometimes very far from where people live.

The village areas at present account for 18% of the irrigated land with total water control. Their results have been much more satisfactory than the results of the large areas since they fit into the peasant environment more easily: the site to be developed is selected following consultation of the peasant farmers; the irrigated plots are allocated in conjunction with those concerned, the operational basis adopted is a production unit suited to the environment, i.e. the family produotion unit; the farmers oan choose whether to consume or market their produce. The social organization of the village area is left to the villagers, who make up homogeneous groups as regards race and family. These groups comprise anything from 25 to 100 people, who choose their own leaders. The latter collect and manage the group's funds, for which the head of the group assumes personal responsibility.

In organizing the large areas account should be taken of the experience acquired in the small units, and an attempt should be made to transpose this experience and benefit from it as far as possible. The oreation of new village areas should slow down and then stop altogether in 1986, partly since no more sites will be available and partly because of the hope that the situation regarding the large areas will improve, and also to tie in with national polioies on self-sufficiency. The small areas oan easily be coped with by the peasant farmers but will never enable self-sufficienoy in food to be attained.

2. NAVIGATION

Although agriculture stands to gain most from the integrated programme, the heads of the OMVS also expect it to have favourable effects on navigation. This opinion is open to discussion, however, sinoe not all experts agree that investment in navigation will show a return.

Mali already has an operational transport link, which could be improved, namely the railway. In Senegal, the Nationale 2 road runs alongside the river from St Louis to Bakel, but it is not in good repair over its entire length. Almost all imports bound for the north or the east (St Louis, Dagana, Podor, Matam, Bakel) are transported at great cost from Dakar. The development of river transport could enable these

areas to be supplied from St Louis and would yield substantial savings.

In Mauritania, there are hardly any roads serving the areas alongside the river. There is only one main road: Nouakchott-Rosso-St Louis. The Nouakchott-Boutilimit road continues to Aleg and is in reasonable condition but the Aleg-Boghé link is not so good. Regular river transport services from St Louis would improve the situation in the entire area of Boghé, Kaédi and the Gorgol.

An attempt should be made to harmonize the area's transport facilities at regional level. There is much talk in African countries which have railways of the need to coordinate rail and road. The OMVS will have an even trickier task in endeavouring to ensure three-way coordination between road, rail and river - and even the sea, since the river Senegal can and should be accessible to sea-going vessels which can berth at the port of St Louis, and either serve as coasters or link St Louis with the ports of Dakar, Nouakchott or Nouadhibou. It may be said that the prospects for river traffic are reasonably good and that, if it is used in close conjuction with road and rail, the river Senegal can play an important role in the economic development of the three countries it crosses or borders.

3. ELECTRICITY PRODUCTION

The generation of an appreciable quantity of energy at a reasonable cost would make it possible to exploit mineral resources which it would otherwise be difficult to use.
The Manantali dam will not be used in the immediate future to produce hydro-electric power, nor will the power plant be installed straight away. This operation will come after the present project, which constitutes the initial stage of the works. It is expected that the operation will be carried out gradually, starting with the commissioning of two turbines, the others being installed at a later stage.

It is nevertheless possible that the urgency of the requirements to be met may disrupt the forecasts, attract the necessary financing and speed up or even precipitate execution of the project.

The region needs electricity for both domestic and industrial purposes. The hydro-electric power produced will be particularly competitive within a 300 km radius around the plant, i.e. mainly to the north of Kayes and to the west of Bamako. The town of Kayes (pop. 48,000) does not consume a great deal of electricity, but the Diamou cement works nearby absorbs 5 800 MWh/year. Requirements of the order of 8 GWh can at present be expected for the region, but they will exceed 50 GWh if the plans for a second cement works at Gangonterie come off.

The requirements of the greater Bamako area (pop. 490 000), which are inadequately met by the Sotuba and Dar-Salam power plants, are around 85 GWh. The Kreditanstalt für Wiederaufbau has estimated that energy consumption in Bamako will be 177 GWh in 1985, 263 GWh in 1990, 379 GWh in 1995, and 513 GWh in 2000.

There are some sizeable mineral deposits within a 300 km radius of the Manantali dam: iron, bauxite, copper, chrome, etc.

Exploitation of the Falémé iron ore deposits, for example, on both the Senegalese and the Malian sides may result in a minimum demand of 100 GWh by 1990-91 if the Miferso project is completed to schedule. If both Senegal's and Mali's reserves are exploited at the same time, the requirements will be much greater.

III. STATUS OF THE OMVS

The OMVS was established on 11 March 1972 by a Convention signed at Nouakchott by the Heads of State of Mali, Mauritania and Senegal. It replaced the Organization of Senegal Riparian States (OERS) (1968-72), which itself followed on from the "Comité inter-Etats" set up in July 1963. Well before 1963 a number of steps had in fact been taken to develop the river Senegal but it should be stressed that the establishment of the "Comité inter-Etats" brought a new factor into play, namely the wish of a number of newly independent states to study and develop jointly the basin of a major watercourse bordering on or crossing their territory.

The structure of the OMVS is as follows:

1. A supreme authority: the Conference of Heads of State and Government - it is presided over on a rota basis for periods of two years by the Head of State or Government of each country in the OMVS. Its role is to draw up cooperation policy and take all decisions relating to general economic development.

2. The Council of Ministers is the top planning and supervisory body, and is presided over by each of the Member States in turn. It formulates general policy on development of the river, utilization of its resources and cooperation among the states concerned. It determines which operations should be given priority, fixes Member States' contributions to the operating budget and the budget for studies and works carried out by the organization.

3. The Office of the High Commissioner is the executive body. It applies the decisions made by the Council of Ministers, and reports regularly on their execution and on any measure taken pursuant to the directives received. It is run by a High Commissioner represents the organization in its relations with international aid institutions and for the purposes of bilateral cooperation.

4. The Standing Committee on Water Flow is made up of representatives of Member States of the organization. It has the task of elaborating the principles and rules for allocating the waters of the river Senegal among the Member States and among the various users, i.e. industry, agriculture and transport. An amendment of 21 December 1978 giving the OMVS full legal personality specifies the exact conditions under which a Member State may withdraw from the organization.

The status of the river Senegal

This was defined by a convention, also signed on 11 March 1972, which states that the river has international status within the territory of the Member States of the OMVS.

It declares that there is freedom of navigation on the river's waters and guarantees equality with regard to port and shipping charges for nationals, merchant vessels and goods of the contracting states, and also for vessels chartered by one or more of them.

The Convention provides for the establishment of common arrangements designed to ensure the navigational safety and controls and of common operating rules under which the contracting states undertake to keep the sections of the river which they are required to maintain navigable at all times. With regard to use of the river for agricultural or industrial purposes, the Convention establishes the principle that the contracting states have to give prior approval to all projects which could significantly change the characteristics of the river, in particular its flow, its navigability or agricultural or industrial usefulness, the degree of purity of the water, the biological features of the fauna and flora, and the intake requirements.

IV. THE CURRENT PROJECT

The current project, in which the EEC is taking part, constitutes the first stage of the OMVS's programme and involves the building of the Diama and Manantali dams.

These two dams will regulate the flow of the river, make it navigable up to Kayes, enable approximately 375 000 ha of land to be brought under irrigation and permit electricity generation at a later stage. It is envisaged that the Diama dam will be completed in 1986 and the Manantali dam in 1988.

Diama

The Diama dam is situated in the lower part of the river delta straddling the territory of Senegal and Mauritania 26 km north of St Louis. The first stone was laid by the Heads of State in December 1979.

It will be what is known as a "mobile dam", submersible at high water, designed to prevent salt water from moving up the delta in the dry season. The Diama dam is much less costly than the Manantali dam.

The Diama dam has a triple role to play:

1. it must prevent the movement of salt water up river from the mouth during the low-water period;
2. it must retain a certain volume of water and increase the irrigation possibilities;
3. it must fill the depressions and lakes, in particular Lakes Guiers and Rkiz which are adjacent to the river bed. When commissioned, the Diama dam alone will enable 42 000 ha of land to be developed.

The works will comprise mainly the following:

i. a mobile dam;
ii. a navigation lock;
iii. a sealing embankment and a shut-off embankment.

The mobile spillway, resting on a concrete still 173 m long, has seven valves 11.5 m high and 20 m wide. These valves will be controlled from the buttresses, by chain winches. The dam will let the 1 000 years' flood through (probability 1/1 000) corresponding to a flow of 6 500 m^3/sec. The navigation lock (dimensions 13m x 175m) will adjoin the dam on the south bank. If the development of river transport or the use of vessels of a different shape or size were to make this necessary, a suitable second lock could easily be built.

The embankments

The dam has two sets of embankments, with one "sealing" embankment and two "shut-off" embankments. These terms used by engineers are apparently synonymous, but the "sealing" embankment is for shutting off the present minor bed while the "shut-off" embankments are for sealing the major bed on both banks.

The Diama dam will be built outside the present minor bed, and the course of the river will be deflected towards it when the dam is completed. This function will be performed by the sealing embankment. The shut-off embankments, which form an extension of the main works on the north and south banks, are intended to cut off the entire major bed. The buttresses of the spillway will support a bridge. so that a road can be built; in the current project this road constitutes only the final part of the access road built between the St Louis road and the site of the dam, but at a later stage it could become an international link between St Louis and Nouakchott.

Manantali

Situated in Mali, on the river Bafing, 90 km south-east of Bafoulabé, this dam forms an essential part of the development works on the river Senegal. Its site has occupied the attention of the experts since 1963.

It will regulate the flow and flood of the river by storing the water in the dam (capacity: 10 000 million m^3) in order to distribute it evenly throughout the year. In the initial stage, control of the flow will make it possible to create an artificial flood when required.

Manantali will be designed to:

i. regulate the flow to a minimum of 300 m^3/sec. (The average flow at Bakel is 750 m^3/sec, but the present minimum flow without regulation is less than 10 m^3/sec, sometimes even nil);
ii. permit continuous year-round irrigation by means of pumping of 375 000 ha planted with a double crop;
iii. make the river navigable as far as Kayes;
iv. permit the installation of a hydro-electric power plant producing 800 GWh of electricity, thereby meeting some of the requirements for working the mineral deposits within a 300 km radius.

The Manantali dam will be much more substantially equipped than the Diama dam, in view of the size and purpose of the structure.

The Dam will have a total length of 1 460 m. It will be of the mixed type, and will consist of a rock-fill embankment with central buttressed concrete structure 493 m long comprising:

the spillway, with a bottom outlet;
the preparations for future installation of the water intake, the penstocks and the foundations of the future hydro-electric plant.

The maximum height of the structure above the foundation rock will be 65 m and the avarage height of the river fall will be some 40 m.

The work will be spread over eight years. Since the site is in a relatively inaccessible mountainous region, before the construction work is started it is essential to build an access road and equip a railway station forming part of the network of the Régie des chemins de fer du Mali (RCFM) in order to transport the necessary materials and equipment.

Ultimately, the impoundage of the Manantali will mean flooding some fifteen villages inhabited by between 9 000 and 10 000 people, who will have to be rehoused.

FINANCING OF THE CURRENT PROJECT

The cost of the project comprising the works to be executed between 1981 and 1988 is estimated at a total of 583.1m ECU divided as follows between the two dams:
Diama: 108.7m ECU
Manantali: 407.5m ECU
Physical contingency reserve: 66.9m ECU
Total: 583.1m ECU

Breakdown of the financing

Diama dam		000 000 ECU
Civil engineering - dam		92.4
Equipment (sluice gates and lock)		9.0
Works supervision		6.4
Training		0.6
Faidherbe bridge		0.3
	Subtotal:	108.7
Physical contingencies		14.7
	TOTAL:	123.4
Manantali dam		
Civil engineering - dam		326.7
Sluice gates		26.8
Access road		13.2
Rehousing		7.6
Land clearance		4.4
Works supervision		14.9
Training		1.2
Railway		12.7
	Subtotal:	407.5
Physical contingencies		52.2
	TOTAL:	459.7
GRAND TOTAL		583.1

The main suppliers of funds to the OMVS are, in order of size of contribution, Saudi Arabia, Kuwait, the EEC, the Federal Republic of Germany, France, Abu Dhabi, the African Development Bank (ADB), the African Development Fund (ADF), Italy, the Islamic Development Bank (IDB) and Canada.

A consortium made up of such a large number of lenders and donors has few precedents. The importance of the Arab funds to the OMVS project should be pointed out. It is no coincidence that the oil-producing Arab countries, which know from experience the rigours of the Sahelian and sub-desert climates, are making a substantial contribution. They are financing some 50% of the total cost of the two dams. The World Bank, on the other hand has been boycotting the project from the outset; its experts are calling into question not the need to develop the river Senegal but the effectiveness of the current project, which, in their view, is too costly and far from certain to produce the intended effects.

The same applies to the United States, which is providing only $ 10m through USAID.

FORWARD FINANCING PLAN

The forward financing plan as established at the most recent meetings of the suppliers of funds held in May and July 1981 is as follows:

	Currency	million ECU(1)
Saudi Arabia	$ 150m	136.4
Kuwait	$ 100m	90.9
Federal Republic of Germany	DM 178m	73.0
France	FF 338m	55.2
Abu Dhabi	$ 70m	63.6
ADB	26.3m u.a. ADB	26.4
ADF	24.0m u.a. ADF	22.2
EEC	15 + 30 + 30m ECU	75.0
Iraq	$ 20m	18.2
Italy	Lit 20 000m + $ 18m	31.7
IDB	$ 20m	18.2
Canada	Can$ 25m	18.9
UNDP	$ 10m	9.1
USAID	$ 10m	9.1
TOTAL		647,9

N.B.: Iraq has announced a contribution of $ 40m to the overall programme of the OMVS.

Iran: since the contribution of $ 4m announced by Iran in 1976 has not been confirmed since 1979, it has not been included in this plan.

(1) at the rate applicable at the beginning of November 1981.

FINANCING TERMS

Saudi Arabia	$ 150m loan (terms not yet communicated)	
Kuwait	$ 100m loan (terms not yet definitive, duration 25 years, rate 3%)	
Federal Republic of Germany	DM 178m	DM 12m grant DM 166m loan 50 years, of which 10-year grace period, rate 0.75%, commitment fee 0.25% a year
France	FF 338m	FF 112m grant (FAC) FF 226m loan (CCCE) 25 years, of which 10-year grace period, rate 3.5%
ADB	26.3m u.a. ADB	20m u.a. loan 20 years, of which 5-year grace period, rate 7.5% 6.3m u.a. loan 25 years, of which 5-year grace period, rate 4.75%
ADF	24.0m u.a. ADF loan 50 years, of which 10-year grace period, rate 0.75%	
Abu Dhabi	$ 70m idem Kuwait	
Italy	Lit 20 000m loan for 5 to 10 years, rate 7.5% $ 18m loan 20 years, of which 5-year grace period rate 4%	

EEC (EDF)	75m ECU	25m ECU grant 45m ECU loan 40 years, of which 10-year grace period, rate 1% and 0.75%
IDB	$ 20m	loan 20 to 25 years, rate 2.5% to 3%
Canada	Can$ 25m	terms not yet laid down
UNDP	$ 10m	terms not yet laid down
USAID	$ 10m	terms not yet laid down
Iraq	$ 20m + $ 20m	terms not yet laid down

BREAKDOWN OF FINANCING (million ECU)

	Saudi Arabia	Kuwait	FRG	France	ADB ADF	Abu Dhabi	Italy	EDF	IDB	Canada	US-AID	Iraq	UNDP	Sub-totals
DIAMA														
Civil engineering-dam	18.0	8.7		37.3	10.8	9.7		7.9						92.4
Equipment (sluice gates, lock)				4.5	4.5									9.0
Works supervision	2.0	1.7		2.7										6.4
Training													0.6	0.6
Faidherbe bridge													0.3	0.3
Subtotal	20.0	10.4		44.5	15.3	9.7		7.9					0.9	108.7
Physical contingencies	2.6	1.4		6.0	2.1	1.4		1.2						14.7
TOTAL	22.6	11.8		50.5	17.4	11.1		9.1					0.9	123.4
MANANTALI														
Civil engineering-dam	80.2	57.1	51.3	3.8		37.6	26.5	42.8	13.7			13.7		326.7
Sluice gates					10.1					16.7				26.8
Access road								13.2						13.2
Rehousing											7.2		0.4	7.6
Land clearance			4.4											4.4
Works supervision	3.1	0.8	0.8		9.4	0.8								14.9
Training													1.2	1.2
Railway			4.1		8.6									12.7
Subtotal	83.3	57.9	60.6	3.8	28.1	38.4	26.5	56.0	13.7	16.7	7.2	13.7	1.6	407.5
Physical contingencies	12.6	8.5	8.3	0.9	1.0	5.6	3.5	4.9	2.1	2.0	0.7	2.1	-	52.2
TOTAL	95.9	66.4	68.9	4.7	29.1	44.0	30.0	60.9	15.8	18.7	7.9	15.8	1.6	459.7
GRAND TOTAL by source financing	118.5	78.2	68.9	55.2	46.5	55.1	30.0	70.0	15.8	18.7	7.9	15.8	2.5	583.1

Source: Commission of the European Communities

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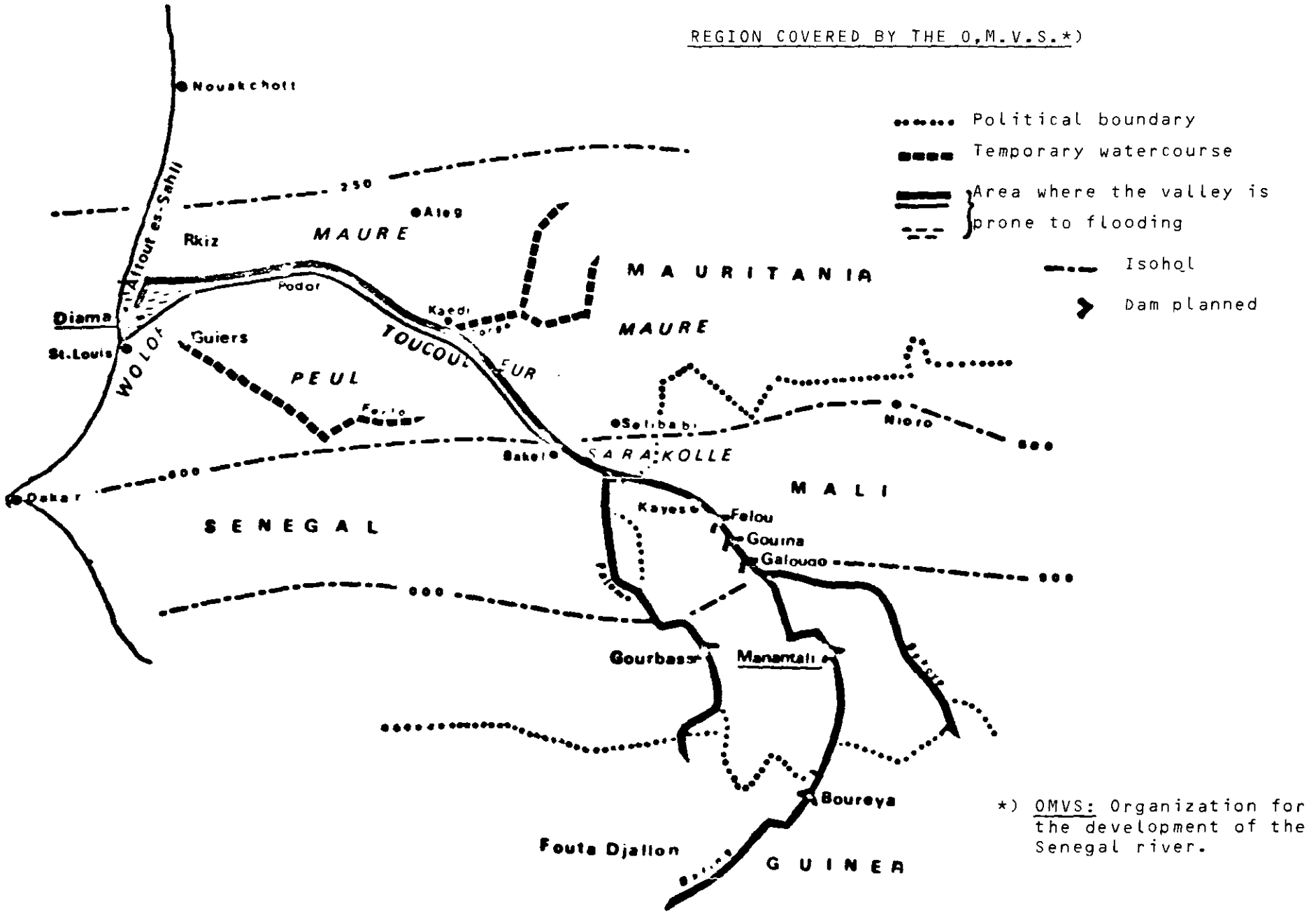
The initial results obtained by the OMVS will be decisive in that they will prepare the ground for further states in the operation. The programme has certainly provoked some criticism as to its ambitious scale and the debts it is incurring for the contracting states. The OMVS programme is also accused of disrupting the environmental balance. The developments will make a considerable difference to the economy of the valley, with consequences that cannot be predicted as yet. The programme must therefore be accompanied by operations designed to counter negative factors which could hinder the development of the region or dilute its effects. As soon as work starts on the Diama dam, the OMVS intends to launch a subregional programme for the eradication of river blindness, which is rife in the Falémé valley.

As has been seen, the objectives of the OMVS programme are very substantial. Even though the region's food shortfall will not be covered immediately, any additional production will have a beneficial effect on the economies of the participating countries, the welfare of the people living on the river banks, and even of those living in the basin's hinterland. In a country such as Senegal, for example, the peasants will no longer have to use most of the money they obtain from selling their groundnuts or their cotton to buy the rice or sorghum they can produce themselves; they will, on the contrary, be able to market their surplus cereals.

In short, if the OMVS programme can manage to free the region from the danger of famine caused by inadequate or nil rainfall, increase agricultural production, make navigation possible in all seasons, promote the generation of electricity and harness it to new industries, eliminate the most serious endemic diseases from the whole basin, and restore ecological balances that are threatened or partially destroyed, the OMVS will have attained its objectives, namely the safety and the economic and social well-being of the inhabitants of the region.

REGION COVERED BY THE O.M.V.S.*)



*) OMVS: Organization for the development of the Senegal river.

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