The National Master Plan for Agricultural Development in Suriname

Abandoned Agriculture on the Left Bank of the Nickerie River

Business Plan

March 2016

Kaplan Planners Ltd
Regional & Environmental Planning

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Introduction

Suriname has a surface of about 164,000 km² accommodating approximately 542,000 inhabitants. The country has 1,500,000 hectares suitable for farming, of which 114,000 hectares are situated in the coastal plain. In 2010, about 34,000 hectares were cultivated (including pasture). On that same land other sub-sectoral agricultural activities also took place. With respect to crops, the following distinction can be made.

- Annual crops: 29,500 hectares
- Perennial crops : 2,221 hectares
- Biennial crops: 2,704 hectares

The share of small holdings in total agriculture was about 20,000 hectares, while state farming covered 14,000 hectares of the total land.

Explanation of the Problem

The rice sector is characterized by uncertainties not just because of its dependency on natural circumstances, but also as a result of:

- Droughts that last too long
- Excess of water
- Poor maintenance of water management infrastructure
- Unavailability of affordable means for production
- Price volatilities in the export market for rice
- Weak vertical relationships between different organizations
- Weak functionality of the relationship between demand and supply
- Marginalized cooperation between the private and the public sector
- Lack of continuity in the export market chain between growers and final consumers
- The small size of the business units
- The expiration, three years ago, of trade agreements with Europe which subsidized rice imports from Suriname

It may be said that after a period of progress, currently the rice sector is experiencing a declining trend.

Objective

The objective of the agricultural development plan in general and this specific plan for rice cultivation is to encourage growth of the agricultural sector in such a manner that sustainable food security and food safety are guaranteed even for vulnerable social populations, as well as to provide for the nation as a whole by increasing export volumes and export profits.

Characteristics of the Sector

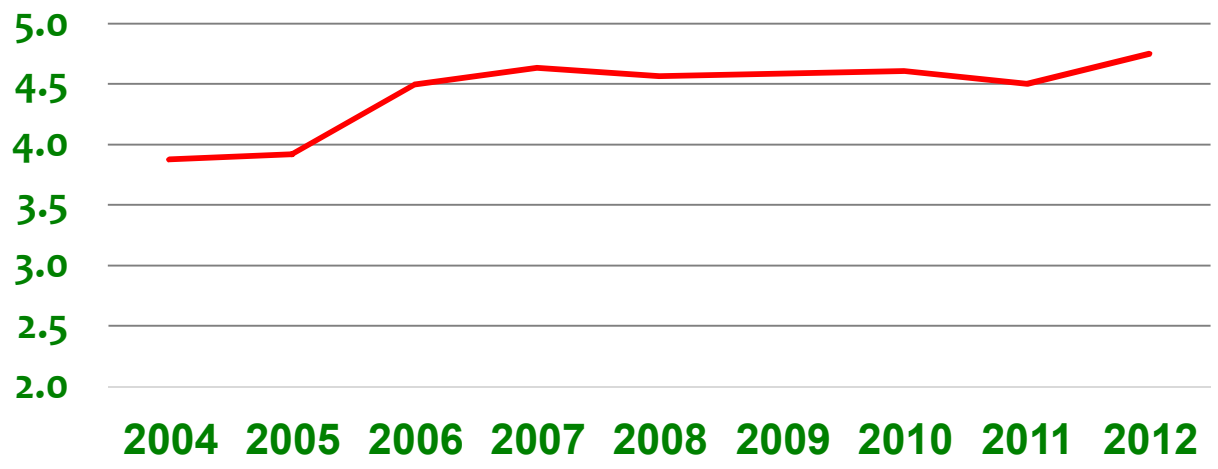
The short-, medium- and long-term objectives for the rice sector should be concentrated on the following issues:

- Lowering the cost of production through increase of yield per hectare
- More efficient use of expensive capital goods through maintaining a sowing scheme by rice farmers
- An increase of cropping intensity, which should be taken to the level above 1.5
- Intensifying research and extension services
- Improvement of the accessibility of means for investment, including exploiting credit sources
- Maintaining a Market Information System (MIS) in order to better respond to development of the export market
- Improvement of the maintenance of dry and wet paddy infrastructure and strengthening the existing and newly established water boards
- Implementation of programs geared to waste management: for example, utilization of husk and straw for energy purposes (generating steam, electricity, drying paddies)
- Utilization of broken rice grains to process food items such as breakfast cereals, bran oil snacks

- Further industrialization of by-products (hard board in house building)

There are approximately 50,000 hectares of land available for rice farming in the Nickerie district, where 1,500 farmers are sowing 27,000 hectares of land per season. A yield of 5 ton/ha is being generated with a volume of 250,000 tons per year, a milling return of 68-72% and an export volume of 56,000 ton in 2012. A total drying capacity of 350,000 tons per season is available, with a 120-ton husking capacity and 70-ton milling capacity per hour. Some 22 mills are operating, of which seven are ISO-22,000 certified. The quality of the rice, 1-2% red rice, 1.0-1.5% chalkiness is reasonable, but there is room for improvement.

Paddy, Yield/Ha 2004-2012



Source: ADRON

Physical Conditions and Irrigation

In addition to the financial and organizational factors mentioned above, there are physical reasons for the low proportion of cultivation of the rice paddies in Nickerie, such as deterioration of local conditions, lack of water because of salinization, and salinization of the soil.

A glance at the map of cultivation reveals that most of the abandoned areas are to be found north of the Nickerie River. The apparent reason for that is the lack of irrigation water, because of ocean penetration into the river which causes salinization, especially during the dry season.

The irrigation systems in Suriname are based on *primary intakes*, which cause the water to flow from its sources to its distribution points. From these points, the water is transported through *secondary systems*, and from there, by means of small dams and pumps, to the edges of farm plots and from there to irrigation ditches. Irrigation networks are accompanied by drainage networks which channel the excess water, including rainwater during wet seasons, in the direction of the ocean.

Irrigation Systems in Nickerie

The irrigation network in Nickerie is based on four sources: the **Corantijn River** and the **Nannie Swamp** which nourish the polders along the southern edge of the district, and the **Nickerie River** and the **Marataka River** which feed the polders along the northern edge.

1. The Corantijn River

The Corantijn River runs along the western border of Suriname. It has a drainage basin of 67,600 km and its annual average rate of flow is approximately 1,600 m^3/s. Its minimum flow is about 100 m^3/s and its maximum about 15,000 m^3/s.

1.1 The Corantijn Canal

The canal originates at the Wakay pump station on the incline of the Corantijn River, which draws an output of 30 m^3/s. The length of the canal is about 66 km and its northern tip connects to the Van Wouw Inlet.

1.2 The Van Wouw Inlet

This is a distribution station, from which water flows in three primary directions: northward from this site by gravity through the Van Wouw Canal in the direction of Clara, and eastward through the Suriname Canal.

1.3 The Van Wouw Canal

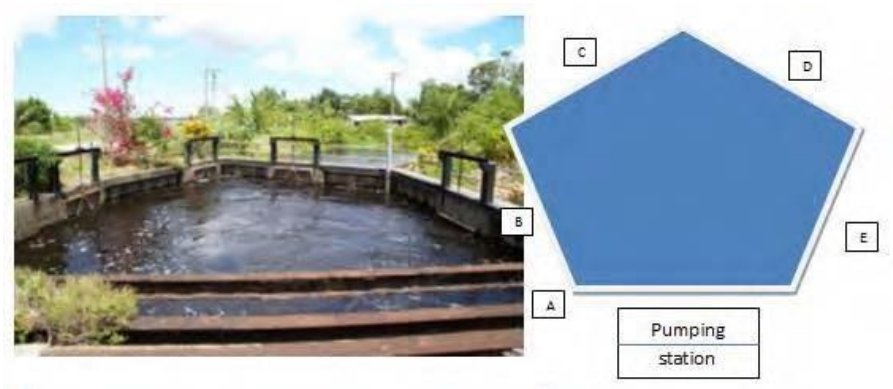
This canal conducts the water by gravity to the Clara pump station, from which the secondary transport systems originate.

1.4 The Clara Pump Station

The pump lifts the water to the distribution pool at the Clara site.

1.5 The Clara Site

From here, the water flows by gravity through ditches to the different polders.



A= gate to Nanni polder; B= two gates to Clara polder; C= gate to Corantijn polder; D= gate to Van Drimmellen polder; E= gate to Wasima polder

1.6 The Suriname Canal

Along the Suriname Canal there are inlets into which the water flows by gravity, for distribution to the eastern plots of the southern edge of Nickerie, to a distance of several kilometers from the distribution point. Further east than that, plots are irrigated directly from the Nickerie River, and this is also the only point south of the river which is irrigated directly from its flow.

Parallel to the Suriname Canal a dike was constructed to prevent the penetration of the swamps in the direction of the rice paddies south of Nickerie. The Suriname Canal and the dike are built side-by-side.

2. The Nannie Swamp

The Nannie Swamp is divided into a northern swamp and a southern swamp. The northern part is approximately 560 km^2, and is the water source used mainly in the dry season. The water level varies between 2.5-3.2 m above sea level, and its potential rate of flow is 9.5 m^3/s. The water flows through the Nanni Creek into the inlet of the Van Wouw Canal, and from there to Clara. It can be assumed that by sealing the northern opening of the swamp with the dike and the western outlet with the Corantin Canal, the swamp water will be directed mainly towards the Marataka River.

3. Nickerie's Southern Edge

3.1 The Nickerie River

The Nickerie River runs along the eastern border of the Nickerie District. Its drainage basin is about 10,000 km and its annual average rate of flow is approximately 175 m^3/s. Its minimum and maximum flows are about 10 m^3/s and 1,800 m^3/s, respectively. The river's waters are collected at the Wageningen site.

3.2 The Wageningen Site

The Wageningen Inlet is at the end of a short channel, located adjacent to the intersection of the Marataka and Nickerie Rivers.

3.3 The Wageningen Pump Station

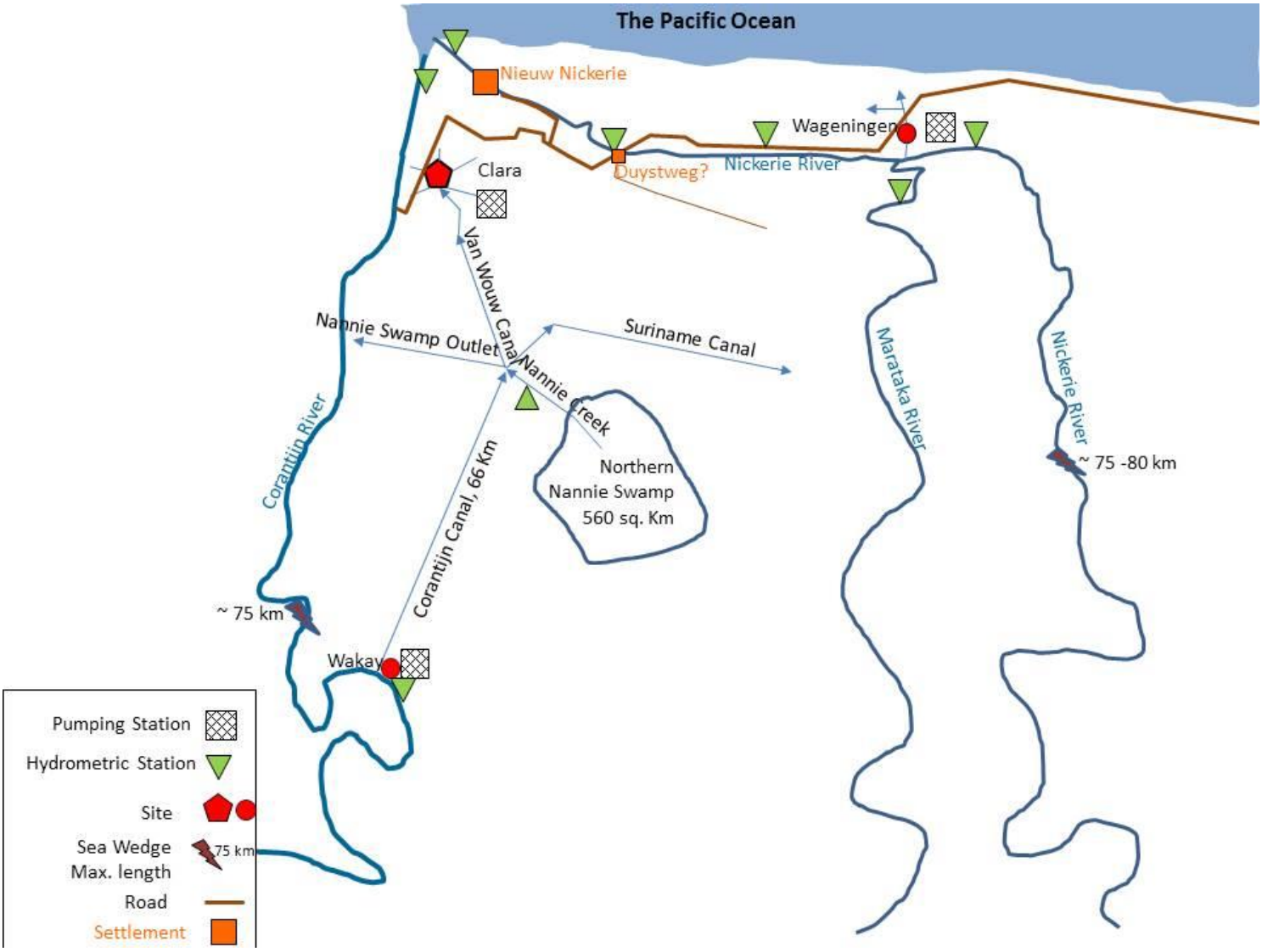
The pump draws the water to be distributed to northern plots.

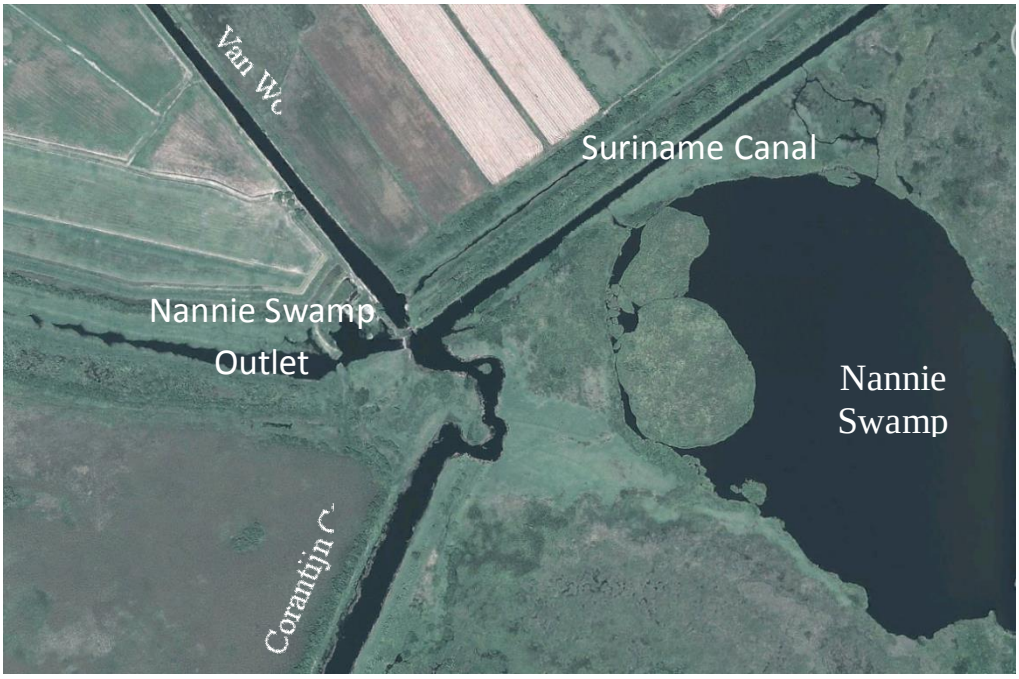
3.4 The Marataka River

The river joins with the Nickerie River at Wageningen. In general, the river is not subject to salinity, and its rate of flow is approximately 12 m^3/s.

The diagram below indicates the main irrigation sources and water transport network in Nickerie:

A photograph of the junction between the exit from the Corantijn Canal and the Nannie Swamp and the entrance to the Van Wouw Canal leading towards Clara:





A photograph of the intersection between the Nickerie River and the Marataka River and the connection with the Wageningen Channel:

Drainage

In parallel to the network of secondary canals run drainage ditches, mostly to the Nickerie River and some to the Corantijn River. Along the Corantijn Canal there are a number of outlets which direct excess water during the rainy season from the Nannie Swamp to the Corantijn River. The northernmost outlet is adjacent to the Van Wouw site (see the Nannie Swamp Outlet in the diagrams above).

Salinity

Background

Sea water which penetrates the rivers creates "rods" or "wedges" of salt (with a chlorine concentration of at least 300 mg/L). During the dry seasons these wedges may reach for tens of kilometers. The maximal distance on the Nickerie RIver is 75-80 km from the estuary, and similarly about 75 km up the Corantijn River. Salt water does not enter the Marataka River (as can be seen in the diagram above). This data is based on information from the 1980s. It is conjectured that today the wedge of salinity does not penetrate as deeply into the Nickerie River, but rather reaches a maximal distance of approximately 50 km[1]. In effect, drawing water from the river expedites the process of salinization, because each drop of water pumped from the river will not serve the goal of pushing the salt water away and preventing its penetration. Therefore, pumping is an important factor in salinization.

The intrusion of the salt wedge and the solution to the problem of the Nickerie River's salinity are important to the topic of soil salinity and the neglect of rice fields in northern Nickerie, which in the past were irrigated with river water year-round, and now are irrigated only in the rainy season. When the salinity level at the Wageningen site reaches 300mg/L or above, pumping is halted.

[1] Planning Drainage & Irrigation for Developing the Rice Sector in Suriname

Solutions

The phenomenon of salinity is recognized in many parts of the world, and there are different means to solve the problem. Mostly mechanical solutions are used which block the salt water and prevent it from entering the fresh water source. Among these are floodgates, tidal/flood barriers, locks, weirs, inflatable dams, and air curtains. These are all various sorts of dams, mostly mobile, which are installed in the area of the river's estuary, and sometimes further up. They assist in washing away the salt or at least preventing its advancement.

These mechanisms have existed in various parts of the world since the end of the 1950s, and they were designed to solve an assortment of problems in regulating and controlling water levels, but some of them are better suited to preventing the penetration of salt water from the ocean to the estuaries of rivers, like in the case of Nickerie.

During the rehabilitation of rice cultivation in Suriname in 2008[2], there was discussion of increasing the flow of the Nickerie River (or using its higher rates of flow) as a means to wash out the salt in order to make irrigation of fields possible. In this context, there was also a suggestion to install a tidal gate across the width of the river at its narrowest point (near the Jamaer Canal). This solution would be very costly. Another solution recommended for study is increased use of the Marataka River waters.

It is worthwhile to explore and update suggestions that have been raised in the past to solve the salinity problem in the Nickerie River. Ultimately, a preferred option or group of options must be selected to solve the problem.

The main suggestions are:

1. Increasing the pumped flow at the Corantin site, from 30 m^3/s to 60 m^3/s, thereby increasing the amount of water arriving at the distribution site. Part of this amount will then be diverted to the Corantin site, by the following means:
    a. Via the Suriname Canal to the Marataka River, and from there to the Nickerie River

[2] See Footnote #1

b. By enriching the Nanni Swamp, and then draining it through the Marataka River into the Nickerie River.

2. Construction of a seasonal reservoir on the Nanni Swamp. This reservoir will lessen the danger of flooding towards the north, and will serve as a water source for the fields in the southeastern area and if necessary channel water to the Marataka River.

Topics for Input

- Initial costs and maintenance costs
- Strength and durability of the dam or other device, especially in a saline environment
- The existence and lifespan of the proposed solution
- Treatment of sediment accumulation
- Ease of operation, including automatic remote operation

Recommendations for Improvement of Water Utilization Methods

In order to rehabilitate the rice fields in Nickerie, to make them efficient and to expand their reach, the proposed first stage is to update and improve the current knowledge relating to hydrological data and the irrigation system, so as to get a comprehensive picture of the existing water needs, the existing rates of flow of the water sources, and the water quality. A physical perspective of the irrigation and drainage networks will allow preparation of a plan for their rehabilitation and treatment, preparing them for optimal functionality.

Solving the salinity of the Nickerie River is a topic of decisive importance for everything relating to irrigation options, especially for the dry season.

All of the following will enable optimal utilization of natural water sources and solutions to problems of drainage and salinity of existing fields, as well as rehabilitation of plots that were neglected over the years and preparation of new plots:

1. Conduction of an in-depth engineering survey and presenting sustainable remedies to the problem of the Nickerie River's salinity, whether by means of raising the flow

rate, increased use of the fresh waters of the Marataka River, or installation of dams to prevent salt penetration from the direction of the estuary. The survey will depend, among other things, on up-to-date information on the location of the salt wedge and the level of salinity of the river water, which will come from the hydrometer stations along the river (see #3 below).

2. The Corantijn River — Despite the existing information, according to which the salt wedge does not reach the Corantijn Canal, and therefore seemingly does not pose a threat to an irrigation network based on the Corantijn River, it is necessary to track the water quality and make sure that the wedge does not advance towards Wakay.
3. Construction of new and modern hydrometer stations at the following sites:
    - The Corantijn River adjacent to Wakay
    - The Nickerie River adjacent to Wageningen
    - The Marataka River at its northern end near to its intersection with the Nickerie River
    - The Nannie Swamp adjacent to Van Wouw
    - Along the Nickerie river (two stations to measure salinity)
    - At the outlet of the Nickerie River to the ocean
    - At the outlet of the Corantijn River to the ocean

    The data from these stations will be sent online for review.

4. Preparation of databases for:
    - Flow rates
    - Water levels
    - Salinity levels
    - Temperatures
    - Precipitation
    - Monitoring water quality, including tracking the concentrations of fertilizers and pesticides
5. Installation of meters to measure the rates of flow at each primary entry point and at each point of exit to secondary canals.

6. Preparation of an assessment of water needs for Nickerie according to the plans for enlargement of the agricultural area.
7. Conduction of a comprehensive survey of the irrigation network (primary and secondary), including mapping and evaluation of the state of the irrigation and drainage canals, the pumping stations, and the existing dams.
8. Estimation of the investment necessary for rehabilitation of the existing systems, including construction of new mechanisms, canals and/or ditches.
9. Update to the water laws of Suriname, based on the existing legislation on the topic, including reference to the Water Boards and water tariffs.
10. Coastal Zone Management (CZM) — Preparation of a plan for protection of the coastal strip of Nickerie, including the agricultural plots there, against the dangers of flooding.

MCP canal: 66 km in length

Cultivation Practices

Tillage practices should be the preparation of the most favorable seedbed for rice seeds.

This involves preparing a thin layer of mud, previously displaced for about 10-15 centimeters and preferably aerated and dried out for at least three weeks, and spreading it over the topmost layer of ground. Weeds, straw and rice stubble should be destroyed as much as possible. Land preparation for rice cultivation involves dry or wet tillage of soils. Dry and wet tillage have to be reviewed from the point of view of crop production and soil management.

Primary Tillage

Much of the rice crop that is subsequently grown under flooded conditions is planted dry or in soil that has been prepared dry. The large effort required for tillage of the soil, has led to the development of the puddling technique.

Secondary Tillage and Puddling

After one or two more final passages with a weed cutter, or an open self-cleaning mud roller, the field is ready for the operation with a mud roller, with or a hard wooden beam.

The first operation in puddling is usually the plastering of the inner surface of the bunds by turning a single furrow, just inside the field with a plough, as soon as the soil is well irrigated.

Dry tillage with crawler and offset plough

Puddling with crawler and attached mud roller plus wooden beam crop treatment

Crop treatment during growth is extremely important for yield and quality. The success of mechanization combined with the use of high yielding varieties, is very much dependent on the famer's understanding of crop treatment during growth. In the past, small scale rice farming was characterized by plenty of handwork, where the entire farm household and even neighbors were involved. Large-scale commercial cultivation of rice cannot be contemplated without the use of aircraft.

Fertilization by aircraft ***Manual fertilization***

Ripening rice ***Combine harvesting rice***

The Situation on the Left Bank of the Nickerie River

Initially, 14,000 hectares of land was issued to farmers on the left bank of the Nickerie River, more specifically within the so-called autonomous area. Originally the land was issued to N.V. Aloupi, N.V. Nieland, Kiesoensingh, Tai Kiem, Satrio, Nasio, Subur and Nirico.

This area now belongs to Mr. Stephen Tjin A Djie, who in the course of time has partially cultivated the land. Mr. Tjin A Djie has cleared 1,300 Ha of land, of which 700 Ha are used for rice cultivation on a rotation basis and 600 Ha as grass land for grazing cattle. Mr. Tjin A Djie is a businessman, who owns excavators, crawlers, tractors and other heavy equipment.

From that position, he is performing as a contractor to State Oil Company who contracted Tjin A Djie to clear the northern part of the SML/Wageningen land ,which was previously planted with rice and now is being converted into fields suitable for sugarcane cultivation.

Mr. Tjin A Djie has demonstrated willingness to further develop the land on the left bank of the Nickerie river. To this end, additional purchases of equipment should be made (see table).

List of Investments in Machines and Equipment in USD

Numbers	Item	Unit price in USD	Total price
1	Crawler	135,000	135,000
2	Excavator	182,000	364,000
30	4 WD tractors	50,000	1,500,000
14	Combines	184,000	2,576,000
29	Offset plough	9,000	261,000
30	Disc harrow	5,000	150,000
30	Weed cutter	3,750	112,500
30	Mud roller	4,000	124,000
30	Wooden beam	200	6,000
30	Ditch wheel	1,500	45,000
30	Cage wheel	2,000	60,000
1	Landplane	15,000	15,000

Soil and Original Vegetation

Literature stated (P.M. De Wit; 1960) that in the Wageningen region, the clay is 20-30 m thick. Indications of marine formation were found in the presence of sea shells in the soil and in the high Mg and Na content in the absorption complex.

In its natural position, before reclamation, the average soil profile, according to DOST (Soil scientist MOA 1956) is constructed as follows:

- 0- 40 cm: more or less decomposed organic material (pegasse)
- 0-10 cm: humus clay
- 30-100 cm: gray clay with a little mottling
- 100 cm: uniform dark clay

The principal vegetation type of the Wageningen area – the area owned by Tjin A Djie , consists of:

- Some reduced strips of parwa bush
- Eleocharis mutata, which is a salty grass
- Brackish swamp with long grassie and bies bisie
- Brackish to fresh water swamps
- Low and high forest pockets

Clearing these kinds of vegetation is absolutely not an easy task. Only sufficient availability of appropriate heavy equipment combined with specialized knowledge can prepare the entrepreneur to properly execute this type of activity. Mr. Tjin A Djie has already succeeded at similar challenges before. As previously mentioned, he is still currently employed in this field of work.

Technical Provisions

The polder is divided into sections. The parcels have a size of 600 m x 100 m. The canals are planned to have dimensions which will allow them to function as storage for both irrigation and drainage water (if necessary). Irrigation canals and drains will be facilitated with a disconnecting cover.

Activities to be Undertaken

- Removal of vegetation to allow for construction of canals and access roads;
- Soil movement for production area
- Clearance of vegetation for production area
- Creation of inlets and outlets amounting to 2,200 parts, each with a diameter of 40 cm
- Construction of 2 units (0.85 m/unit) for pumping water in or out

Investments in Water Management Infrastructure

Item	USD
Parcel inlet and outlet	89,860
Other in- and outlets	15,552
Pumping Units	129,600
Total	**235,012**

The development of the area has been spread over five years. This is done to avoid a heavy burden of capital at the beginning and also to create a properly managed large rice farm.

During the first season of Year 1, the farmer will complete the first 400 Ha of land and then continue as indicated in the table below.

New Acreage Development and Area for Exploitation; Year 1- 5

Year	**1**		**2**		**3**		**4**		**5**	
Season	**1°**	**2°**	**1°**	**2°**	**1°**	**2°**	**1°**	**2°**	**1°**	**2°**
Old area of rice cultivation in Ha	**-**	**700**	**-**	**700**	**-**	**700**	**-**	**700**	**-**	**700**
Newly developed area in Ha	**400**	**400**	**450**	**450**	**450**	**450**	**300**	**300**	**-**	**3,200**
Newly developed area for exploitation in Ha	**-**	**400**	**800**	**1,200**	**1,650**	**2,100**	**2,550**	**3,000**	**3,300**	**3,300**
Total area for exploitation in Ha	**-**	**1,100**	**800**	**1,900**	**1,650**	**2,800**	**2,550**	**3,700**	**3,300**	**4,000**

The climate is characterized by two dry seasons and two rainy seasons.

- Small dry season (February- March)
- Main rainy season (April- August)
- Main dry season (September- November)
- Small rainy season (December –January)

The tasks of soil movement, excavating canals, dry land preparation, and combine harvesting of rice must be performed during the dry period for optimal results.

Seasonal Purchases of Machines and Equipment – In numbers

Year	1		2		3		4		5	
Season	1°	2°	1°	2°	1°	2°	1°	2°	1°	2°
Excavator	1	-	-	-	-	-	-	-	-	--
Crawler	1	-	-	-	-	-	-	-	-	-
Tractor	-	4	4	4	4	5	4	5	2	-
Combine	-	2	1	2	2	2	2	2	1	-
Landplane	1	-	-	-	-	-	-	-	-	-
Offset plough	-	4	4	4	4	5	4	5	2	-
Disc harrow		4	4	4	4	5	4	5	2	-
Weed cutter	-	4	4	4	4	5	4	5	2	-
Mud roller	-	4	4	4	4	5	4	5	2	-
Wooden Beam	-	4	4	4	4	5	4	5	2	-
Ditch wheel	-	4	4	4	4	5	4	5	2	-

These tables propose a spread in the purchase of machines, equipment and investment in water management infrastructure according to the intended area development.

Seasonal Investment in USD (1,000) for Machines, Equipment and Water Infrastructure

Year	**1**		**2**		**3**		**4**		**5**	
Season	1	2	1	2	1	2	1	2	1	2
Excavator	182.0	-	-	-	-	-	-	-	-	-
Crawler	135.0	-	-	-	-	-	-	-	-	-
Tractor	-	200.0	-	-	-	-	-	-	-	-
Combine	-	368.0	184.0	368.0	368.0	368.0	368.0	368.0	184.0	-
Landplane	15.0	-	-	-	-	-	-	-	-	-
Offset plough	-	36.0	36.0	36.0	36.0	45.0	36.0	36.0	18.0	-
Disc harrow	-	20.0	20.0	20.0	20.0	25.0	20.0	20.0	10.0	-
Weed cutter	-	15.0	15.0	15.0	15.0	18.7	15.0	15.0	7.5	-
Mud roller	-	16.0	16.0	16.0	16.0	20.0	16.0	16.0	8.0	-
Wooden Beam	-	0.8	0.8	0.8	0.8	1.0	0.8	0.8	0.4	-
Ditch wheel		6.0	6.0	6.0	6.0	7.5	6.0	6.0	3.0	-
Sub total	332.0	661.8	277.8	461.8	461.8	485.2	461.8	461.8	230.9	-
Infrastructure	5.9	5.9	14.6	14.6	23.8	23.8	33.6	39.5	-	-
Total	337.9	667.7	292.4	476.4	485.6	509.0	495.4	501.3	230.9	-

The total investment in machines and equipment is USD 3,811,400.

The following table explains the fixed and variable costs of machines and equipment. In the same table, detailed fixed and variable costs are illuminated.

Operational Costs Machine and Equipment Pool per Unit per Year in USD

Purchase value in USD	**182,000**	**135,000**	**50,000**	**184,000**	**15,000**	**22,440**	
Item	Excavator	Crawler	4 WD Tractor	Combine	Landplane	Equip-ment	
Depreciation Period in years	15	12	10	8	20	15	
Fixed costs							Total
Depreciation	12,000	11,250	5,000	23,000	750	1,496	53,496
Interest (8%)	14,560	10,800	4,000	14,720	1,200	1,795	47,075
Repair & Maintenance (4%)	7,280	5,400	2,000	7,360	600	-	22,640
Insurance (1%)	1,820	1,350	500	1,840	150	224	5,884
Total fixed costs	**35,660**	**28,800**	**11,500**	**46,920**	**2,700**	**3,515**	**129,095**
Variable costs							
Fuel	(20 liters/hr) 36,363	(20 liters/hr) 36,363	(20 liters/hr) 43,636	(18 liters/hr) 15,327	-	-	131,689
Lubricants (0.5 % of fuel costs)	180	180	218	77			655
Salaries	-	-	-	-	-	-	
Total variable costs	**36,543**	**36,543**	**43,854**	**15,404**			**132,344**
Total costs	**72,203**	**65,343**	**55,354**	**62,324**	**2,700**	**3,515**	**261,439**

Salaries of Staff and Personnel in USD

Numbers	Functions	Salaries per month in SRD	Salaries per year	SRD	USD
1	Manager	2,500	12 x 2,500 x 1.25	37,500	11,363
3	Secretarial personnel	1,500	12 x 1,500 x 1.25	67,500	20,454
2	Repair and maintenance personnel	1,500	12 x 1,500 x 1.25	45,000	13,636
30	Machine drivers	1,500	12 x 1,500 x 1.25	675,000	204,545
3	Field workers	1,200	12 x 1,200 x 1.25	54,000	16,363
	Total			**879,000**	**266,361**

Cash Flow in USD

Year	Ha	Yield/ha	Mton/ha	Price/ton In USD	Gross Revenues In USD	Costs In USD	Surplus/ shortage
1	1,100	5.0	5,500	191	1,050,500	706,809	343,691
2	2,700	5.0	13,500	191	2,578,500	1,734,809	843,691
3	4,450	5.0	22,500	191	4,249,750	2,856,740	1,393,010
4	6,250	5.0	31,250	191	5,968,750	4,013,338	1,955,412
5	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501
6	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501
7	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501
8	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501
9	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501
10	7,300	5.0	36,500	191	6,971,150	4,690,649	2,280,501

Cash Flow II, USD

Year	1	2	3	4	5	6	7	8	9	10
Sales raw material (paddy)	1,050,500	2,578,500	4,249,750	5,968,750	6,971,150	6,971,150	6,971,150	6,971,150	6,971,150	6,971,150
Adjusted production cost raw material	649,000	1,593,000	2,625,500	3,687,500	4,307,000	4,307,000	4,307,000	4,307,000	4,307,000	4,307,000
Operational costs Machine and equipment	13,252	32,529	53,010	74,696	87,949	87,949	87,949	87,949	87,949	87,949
Salaries personnel	44,557	109,368	178,230	251,142	295,700	295,700	295,700	295,700	295,700	295,700
Total costs	706,809	1,734,897	2,856,740	4,013,338	4,690,649	4,690,649	4,690,649	4,690,649	4,690,649	4,690,649
Cash flow	343,691	843,691	1,393,010	1,955,412	2,280,501	2,280,501	2,280,501	2,280,501	2,280,501	2,280,501

Conclusions and Recommendations

Taking into consideration the structural problems with which the rice sector is confronted, the sector must be subject to a restructuring process that should be executed in a sustainable manner. This plan relies on the fact that Mr. Tjin A Djie is not new in the business, but has considerable knowledge, experience and skills, making him capable of successfully developing the left bank area under discussion.

As shown above, the net income value will definitely put the entrepreneur in a position to pay back the loan to which he is willing to commit himself.

APPENDIX

Stondansie independent and dependent acreage

Stondansie independent acreage								
Irrigation sources: MCP canal and Nani swamp + 6,8 m³/sec at full capacity)								
			Planted acreage					
			2010		**2011**		**2012**	
Polders	**Issued acreage**	**Standing acreage**	**Small crop**	**Main crop**	**Small crop**	**Main crop**	**Small crop**	**Main crop**
MCP	12,500	300	300	300	300	300	300	300
Westelijke polders	7,868	6,902	3,710	5,641	4,112	6,245	4,375	5,809
Oostelijke polders	8,875	7,785	4,383	6,647	4,856	7,356	5,990	7,819
Sub-total (1)	**29,243**	**14,987**	**8,393**	**12,588**	**9,268**	**13,901**	**10,665**	**13,928**
Estate farming	4,125	3,590	2,440	3,660	2,440	3,660	2,440	3,660
Sub-total (2)	**33,368**	**18,577**	**10,833**	**16,248**	**11,708**	**17,561**	**13,105**	**17,588**
Stondansi dependent acreage **Irrigation sources: Nickerie river and Maratakka river**								
SML (Wageningen)	19,560	9,700	1,725	3,836	3,278	2,084	2,061	2,061
Left bank Nickerie river **Nickerie river**	14,000	12,319	3,200	4,500	3,500	4,800	3,800	5,000
Right bank Nickerie river	7,300	6,450	1,100	2,800	1,500	3,400	1,200	3,936
Maratakka river	2,828	2,230	0	0	0	0	0	0
Middestands polder (MSP)	1,748	1,534	390	380	400	460	700	930
Sub-total (3)		**32,223**	**6,415**	**11,516**	**8,678**	**10,744**	**7,761**	**11,927**
Total (1+2+3)		**50,800**	**17,248**	**27,764**	**20,386**	**28,305**	**20,866**	**29,515**