



REPUBLIC OF BOTSWANA

Department of Crop Production (DCP)

Ministry of Agriculture

**CONSULTANCY SERVICES FOR THE FEASIBILITY STUDY
FOR THE ZAMBEZI INTEGRATED
AGRO-COMMERCIAL DEVELOPMENT PROJECT**



SGI Studio Galli Ingegneria S.p.A



*in Joint Venture with
Metaferia Consulting Engineers PLC*



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0 FOREWORD

The Consultancy Services for the **Zambezi Integrated Agro-Commercial Development Project (ZIACDP)** were sponsored by the Ministry of Agriculture of the Republic of Botswana, Department of Crop Production (MoA/DCP) to “establish a viable commercial agricultural development [project, aimed to] improve the country’s food security, diversify agriculture, meaningfully contribute to the country’s GDP and create direct employment for over 4,000 people” through a new irrigation development on an area of about 45,000 Ha in Chobe District, utilizing water from the Chobe/Zambezi River. The designated area for the ZIACD Project was identified near the existing Pandamatenga Commercial Farms, about 110 km South of Kazungula, 400 km North of Francistown..

The Consultancy services for the *Feasibility Study, Field Investigations, Agribusiness Study, Final Design, Environmental Study, Financial and Economical Study and Bankability Study* were assigned to SGI S.p.A. (Italy) in joint venture with MCE P.L.C (Ethiopia) in January 2014.

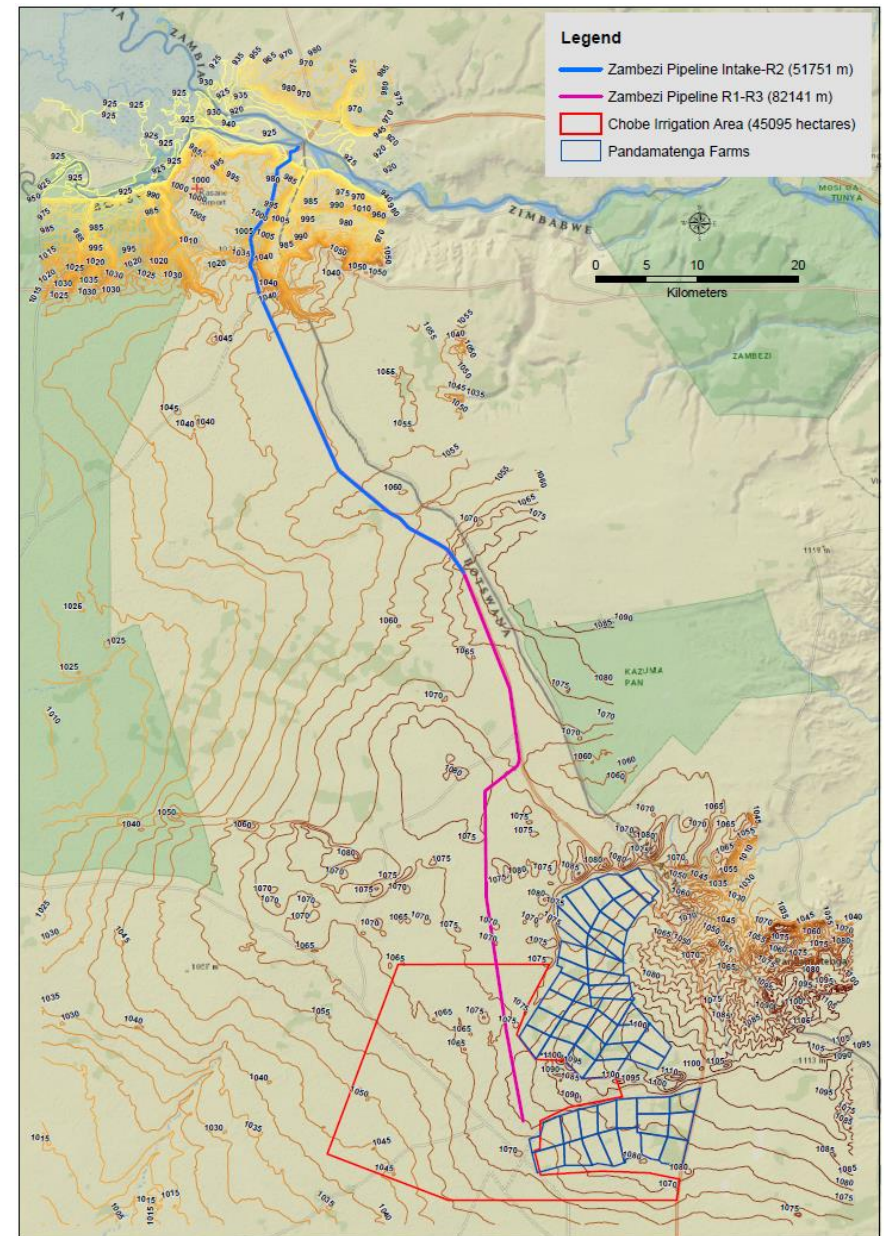


Figure 1 - Location of the Project Area

1 THE PROPOSAL

The Consultant assessed and designed the development of a high intensity irrigated agricultural area to be cropped both in the “dry” and the “wet” season, in accordance with the suitability of land, the availability of water, and the local and international market opportunities:

- **The detailed soil survey** rated about 15,000 Ha of sandy loam and sandy clay loams soils as suitable for both rainfed and overhead *pivot irrigation* (S2 and S3 FAO Soil Classification, green and blue in Figure 2 below). Some additional 10,000 Ha of sandy soils (ibidem, green and blue) were rated as suitable for *drip irrigation* system and for fruit trees including various types of citrus and mangoes, regardless of their low water holding capacity.
- **The infrastructure** of the Project is estimated to have an overall construction cost of about 3.8 billion Pula (B BWP) (close to 400 Million USD) and an annual operation and maintenance cost of 0.2 B BWP. It consists of head works (reservoir and pumping stations), irrigation facilities (distribution pipes, pivot and drip irrigation system) subdivided in 3 independent lots, roads, drains and fencing. Land preparation works (land clearance and levelling) and immigrant labourers facilities (satellite village) are also included.
- **The expected annual water requirement** at the field is about 270 million cubic metres (MCM), out of which about a half is for fruit trees in the drip area. The maximum annual abstraction from the Zambezi River available for agriculture is 345 MCM, largely enough to cover water for irrigation, including transfer and application losses, and additional minor water consumption allocated for livestock, processing, farmstead activities and households.
- **The proposed cropping pattern** includes cereals (maize and wheat in the dry season, Sorghum in the wet season), oilseeds and pulses (soybean in the dry season, sunflowers and beans in the wet season), fodder crop (alfalfa) and fruits (mangoes, both all year around). The overall crop intensity is 200% and the net irrigated area is about 25,000 Ha (34,100 gross). Drip irrigation will be for fruit trees and pivot irrigation for all the remaining crops.
- **The estimated total average annual production** from crops at full development is about 156 thousand tons; similarly 216 thousand tons net (240 gross) are expected from fruit trees.

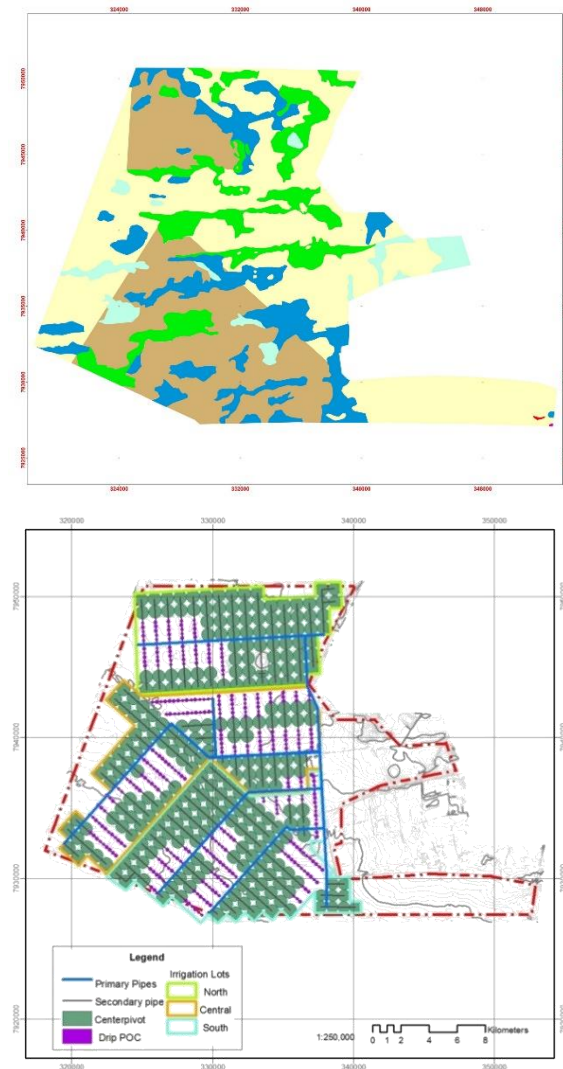


Figure 2 – Soils classification map and Layout of the irrigation system

Investment costs are referred to access and field roads (23%), irrigation pipes and pumping station (22%), drains (16%), housing facilities (13%), *drip* irrigation (6%), *center pivot* irrigation (6%), land works (9%) and other works (3%), while the processing plants have a minor share (2%). On farm costs alone, referred to field irrigation and field roads, sum up to 23% of the total investment costs.

2 THE AGRIBUSINESS AND ITS ECONOMIC IMPACT

Annual revenues from the Project are expected to rise up close to 1,500 Million Pula (M BWP) once full production is achieved (year 8): as much as 890 M BWP/y from farming (half from the sale of fruits from the farmers to the processing plant, and therefore not to be accounted for twice in the total revenues of the Project) and 1,045 M BWP/y from the processing activities (again, largely from fruit).

The total agricultural production cost, including machines rent, labour, and material inputs (seeds, fertilizers, pest control products, etc), but not the infrastructure related cost (irrigation water, energy, maintenance and land rent) which will be considered later, is estimated to reach 315 M BWP/y at full production, one third of which spent for fruit trees.

The total operation and maintenance cost (O&M: energy, staff other than field workers, and maintenance for all the works including irrigation water application facilities) is expected to be close to 200 M BWP/y once all the designed works are implemented.

The investment cost of the entire Project is 3,790 M BWP and is distributed along the first six years.

Considering the figures above, the Project shows a **positive financial performance** and therefore the opportunity to repay for its overall costs, including investments, as shown from the cash flow and the key financial indicators below, where agricultural benefits (or profits) are revenues net of agricultural production costs (figures in the years from 10 to 30 are repeated identically):

Table 1 – Expected inflows and outflows of the Project (real values in MBWP/y)

Year	1	2	3	4	5	6	7	8	9	10-30
BENEFITS	17	96	210	313	434	647	832	958	958	958
INVESTMENT	749	1,498	1,123	374	24	24	-	-	-	-
O&M COST	47	120	180	200	200	200	200	200	220	200

- FIRR: 13.4 % (Financial Internal Return Rate)
- FNPV: 1,184 M BWP (Financial Net Present Value with 10% Discount Rate)
- PPB: 11 years (Payback Period)

The Project is expected to have a remarkable **contribution to the economy of the Country**. Indeed, the estimated production will positively affect the national trade balance – and therefore foreign currency availability – both by producing import substitutes and increasing the agricultural export. New stable and long-term employment opportunities will be generated due to the envisaged level of effort for the various business activities of the Project, with an estimation of more than 2,600 direct fully employed individuals.

All these considerations were included in the economic **cost-benefit analysis**, where inflows and outflows resulting from financial analysis were adjusted to mirror their contribution to the national welfare, rather than to the Project budget. Applying the considered Shadow Conversion Factors (SCFs: 0.75 for capital, 1.05 for export and import-substitute products, 0.8 for labour cost) the socio-economic performance indexes resulting from the implementation of the Project are the following:

- EIRR: 20.2 % (Economic Internal Return Rate)
- ENPV: 3,003 M BWP (Economic Net Present Value with 10% Discount Rate)
- BCR: 1.31 (Benefit/Cost Ratio)

The financial and economic performance of the ZIACD Project was studied as if no contribution is required from it for the construction of Chobe-Zambezi water transfer scheme, neither directly, nor in terms of water supply cost. Nevertheless the Project Authority incomes as mentioned in the next chapter can be allocated to this purpose.

3 FINANCING AND MANAGEMENT

The proposed management of the facilities in the area follows a Public-Private Partnership approach balancing revenues and costs among the *entities* participating in the Project:

- A **Project Authority** (PA) should be established under the Ministry of Agriculture - Department of Crop Production. It will own and be in charge of the operation, maintenance and replacement of the main infrastructure of the Project, including the reservoir, the central pumping station and the head works, the irrigation and drainage infrastructures down to the secondary level, the service roads and any facility outside the farm gate. It will also own and rent out to the farmers the farm land and the machines needed for the agricultural operations and supply pressurized irrigation water to the farm gate.
- **The Farmers** will run the whole agricultural business within the farm gate, earning from the sale of the crops and paying for the relevant production cost such as manpower hiring, rent of machines, input purchase (seeds, fertilizers, pesticides, etc) and eventually irrigation water, land rent and energy. Additionally, farmers will be responsible for the implementation, operation, maintenance and replacements of any facility within the farm gate (tertiary and lower level pipes, furrows and drains; pivot and drip irrigation system; field roads; etc). In the proposal about 50 farmers are expected to run 500+ Ha wide farms.
- **The Industrialists** will process milk or goods coming from the farms (inputs for animal feed and mostly fruit) and will own and operate the relevant processing plants and facilities. They will buy inputs from the Farmers and sell the products to the local, national or international market.

Once such institutional framework is applied – and considering that the overall Project shows a satisfactory financial performance – the relevant costs and revenues can be assigned to each participating entity according to its own role and responsibility.

Tariffs, rentals and duties are therefore introduced to divert a fair share of the earnings towards the Project Authority to pay for the investment and O&M costs it is in charge of, without reducing the commercial entities (Farmers and Industrialists) below an appealing convenience threshold: a tariff of 0.55 BWP/m³ for pressurized water (repaying both water supply and energy cost), a rent of 400 BWP/Ha/year for land and an average 14% duty on processed goods revenues was proposed among the many possible and the resulting financial performance for each one of the entities is shown in table 2 below.

Table 2 – Financial performance indicators for the Entities

	FNPV(10%) MBWP	FIRR	PBP (years)
Project	1,184	13.4%	11
Project Authority	-513	7.0%	15
Farmers	723	15.0%	10
Industrialists	974	n.a.	n.a.

Farmers and Industrialists still share a Financial Net Present Value (10% Discount Rate) close to 1.7 B BWP (about 14.5 M BWP for each 500 Ha wide farm) and keep on having a Financial Internal Rate of Return and an Operating Margin respectively not below 15%.

Under this same reference the FNPV of the **Project Authority** is below zero if the same discount rate assumed for the commercial entities is considered. Nevertheless, once the Discount Rate is reduced to a still reasonable 6% (or even to 3.5%, i.e. slightly more than the currently traded interest rate for Bank of Botswana Certificates), the expected FNPV of the Project Authority turns to positive, reaching 238 M BWP (or 1,120 M BWP). These earnings can be returned to the National Budget to **contribute to the construction of the Chobe-Zambezi water transfer scheme** or used to pay a tariff to the Water Utilities Corporation (WUC) for the water it will supply to ZIACDP head reservoir.

Details about the expected inflows (benefits) and outflows (investments and O&M costs) for the whole project and for each single participating entity and eventually the cash flow originated by their combination referred to the proposed institutional configuration are shown in the tables and graphs below (figures in the years from 10 to 30 are repeated identically).

Table 3 – Inflows and outflows for the “Entities” of the Project (real values in MBWP/y)

Year	1	2	3	4	5	6	7	8	9	10-30
BENEFITS										
Project	17	96	210	313	434	647	832	958	958	958
Project Auth.	68	206	312	351	354	362	370	375	375	375
Water	30	89	134	149	149	149	149	149	149	149
Land	3	8	12	14	14	14	14	14	14	14
Processing	23	71	111	128	131	139	146	151	151	151
Machines	12	37	55	61	61	61	61	61	61	61
Farmers	-58	-135	-142	-87	17	182	321	416	416	416
Industrialists	8	25	40	49	62	103	141	167	167	167
INVESTMENT										
Project	749	1,498	1,123	374	24	24	-	-	-	-
Project Auth.	568	1,137	853	284	-	-	-	-	-	-
Farmers	175	351	263	88	-	-	-	-	-	-
Industrialists	5	10	8	3	24	24	-	-	-	-
O&M COST										
Project	47	120	180	200	200	200	200	200	200	200
Project Auth.	37	90	135	150	150	150	150	150	150	150
Farmers	10	30	45	50	50	50	50	50	50	50

Table 4 – Cash flow for the “Entities” of the Project (real values in MBWP/y)

Year	1	2	3	4	5	6	7	8	9	10-30
Project	-778	-1,522	-1,093	-261	210	423	632	758	758	758
Project Auth.	-537	-1,021	-676	-83	204	212	220	225	225	225
Farmers	-244	-515	-450	-224	-32	132	271	366	366	366
Industrialists	3	15	33	47	38	79	141	167	167	167

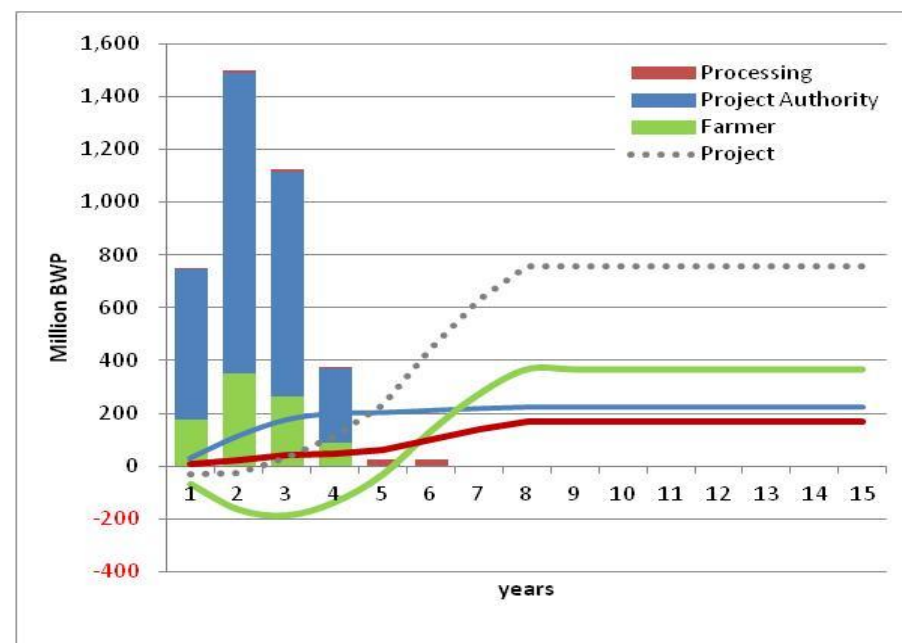


Figure 3 –Benefits net of O&M costs (lines) against Investments (bars)

4 SENSITIVITY ANALYSIS

Based on the sensitivity analysis results it can be said that the financial performance of the project is virtually un-elastic as far as changes in the implementation schedule and in energy costs are concerned. Reduction in yields and sell prices or rising in construction costs may have larger even though not ultimately compromising effects, being an IRR not far below 5% the worse registered case. On the other hand, a positive trend in prices or yields may rise the financial internal rate of return of the investment close to or above 20%.

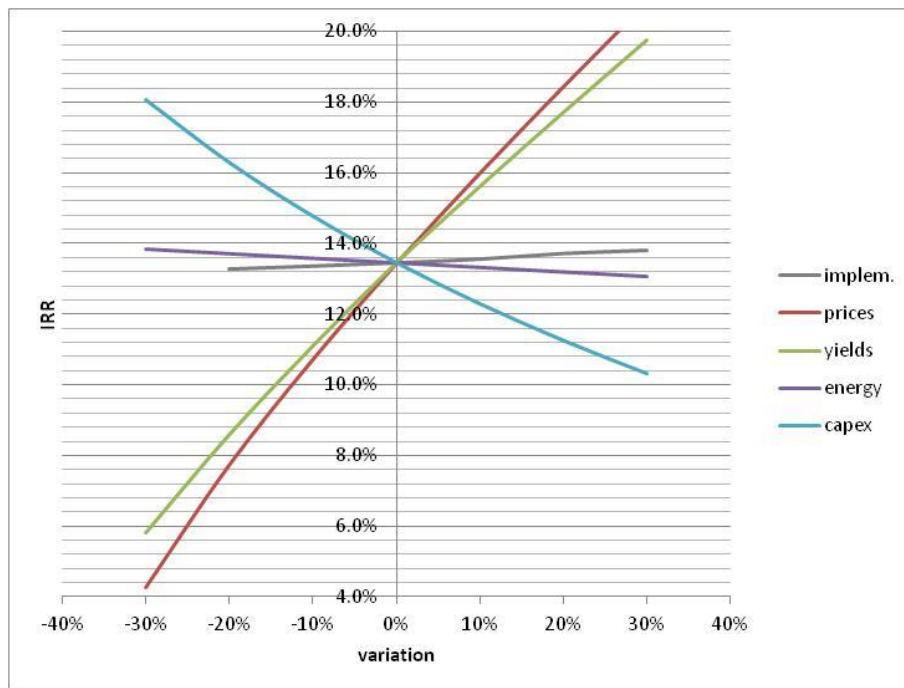


Figure 3 – Sensitivity analysis of the financial performance (IRR)

5 BANKABLE STUDY

The Farmers (about 50 units farming 500 Ha each) will need financing to cover an overall deficit of 1,465 M BWP (close to 30 M BWP per farm) in the first 5 years. The proposed financing option is structured in a two-step-disbursement loan over a fifteen years repayment period at fixed interest rates, assuming the loan is provided to each single Farmer by a Commercial Bank or a Development Financial Institution in the framework of a financing facility relying on collaterals from the Project Authority or the Government of Botswana. The loan is approached as the combination of two subsequent ones starting in year 1 and year 3 respectively, each one with a principal of 650 MBWP and a 6% interest rate, both ending at year 15 corresponding to a 70 and 78 M BWP/y instalment respectively (about 1.4 and 1.6 M BWP/y per farm); equity shall be paid in by the Farmers in the first two years for a total disbursement of 650 M BWP (about 4.8 M BWP per farm) in order to participate in the investment with one third of the capital and to keep the coverage ratio of the loans above acceptability levels.

The Project Authority will need to cover an overall deficit of 2,317 M BWP in the first 4 years. The proposed financing option is again structured in a two-step-disbursement loan, with the first one lasting 20 years and the second one 15 years at 2.5% fixed interest rates, assuming the loan is provided by the African Development Bank to the Project Authority under sovereign guarantee. The loan is therefore approached as the combination of two subsequent ones starting in year 1 and year 3 and with a principal of 1,300 M BWP and 600 M BWP respectively. The PA would be required to participate in the investment with the overall amount of 900 M BWP (32% of the whole capital) to be paid in the first five years, provided no coverage ratio is requested for sovereign guaranteed loans.

The Industrialists will mainly have to face the need to finance working capital rather than long term investment. On the other hand, most of it (about a half) is spent within the project to buy crops and mostly fruits to be processed, allowing for a reciprocally profitable collaboration among buyers and sellers participating in the same vertically integrated business.

6 CONCLUSIONS

The ZIACD Project proved to be a **promising and financially viable** venture and a profitable way to take advantage of – and marginally repay for – the irrigation opportunity given by the Chobe/Zambezi River water transfer scheme.

The proposed **public-private partnership business model** engages three different kinds of entities, naturally committed in an integrated environment: the *Project Authority*, in charge of the construction and the management of the infrastructure, the *Commercial Farmers*, focused on farming, and *Processing Industrialists*.

A **reasonable setting of charges** will enable the PA to recover from the Farmers and the Industrialists part of the benefits they receive from the sale of the raw or processed agricultural goods, whose production is eventually a consequence of the combination of the producers' efforts and of the facilities the PA is actually providing. But at the same time it leaves in the hands of the commercial enterprises an attractive profit.

Nevertheless the need to introduce a large amount of untraditional crops (**Mango trees** above all) due to specific suitability of the soils in the Project area calls for a careful management of the selection of the best fitting species and of the processing and logistic issues. The analysis showed apparently that processing is crucial to trade efficiently most of the production and to overcome the disadvantages of being far from market and shipping place and within a wildlife area. On the other hand the commercialization of processed goods rather than raw ones and staples is a challenging opportunity to climb the agribusiness value chain upwards, gaining to the Botswana economy a larger share of the added value from agricultural production.

Financially wise, **soft loans** from Development Banks and Commercial Banks, supported by equity from the borrower and sovereign guarantee from the State of Botswana, can effectively leverage the capital investment and even though the presence of a processing section raised the need of working capital, a large part of it is spent within the project to buy crops (and mostly fruits to be processed), allowing for a reciprocally profitable collaboration among buyers and sellers participating in the same vertically integrated business.

Finally, a **mixed pattern of staple crops, cash crops and fruits is intensively farmed** on a large portion of the project area and partially processed on site, showing a satisfactory financial performance and dramatically **improving the food security and the import/export commercial balance of Botswana** in the forthcoming years.