Concept Note for the Use of Resources from the FIP Competitive Set-Aside

1. **Country/Region**:	Brazil / Minas Gerais	2. **CIF Project ID#**:	
3. **Project/Program Title:**	Macauba – Plant Oil with Impact		
4. **Date of Endorsement of the Investment Plan:**	May 18th, 2012		
5. **Funding Request (in million USD equivalent):**	*Grant:*	*Non-Grant (loan, equity, guarantee, etc.):*	
6. **Implementing MDB(s):**	Inter-American Development Bank (IADB)/FOMIN	X☐ Private sector arm ☐ Public sector arm	
7. **Executing Agency:**			
8. **MDB Focal Point and Project/Program Task Team Leader (TTL)**:	*Headquarters- Focal Point:* *Gloria Visconti* *Climate Lead Specialist* *IADB* *gloriav@iadb.org*	*TTL:* *Gregory Watson* *Climate Senior Specialist* *FOMIN* *gregoryw@iadb.org*	

I. Project/Program Description

MACAUBA – PLANT OIL WITH IMPACT – DESCRIPTION

By establishing agroforestry systems with Macauba, the project aims to build the first value chain for vegetable oil production **without land use change** in Brazil. Macauba palm trees will be integrated into existing pastures keeping the number of cattle constant**.** Hence, vegetable oil production will not reduce the pastures' productivity. The project is located in the Cerrado region of Alto do Paranaiba, Minas Gerais, Brazil.
It directly translates knowledge and experience from a European Union-funded EUR 2.7m research project at Leuphana University Luneburg (Germany) into action. In the context of this research project, a **feasibility study was conducted** in Minas Gerais 2012-2013. In total, 300 tons of Macauba fruits were harvested to

Picture 1) Wild Macauba trees on pasture land

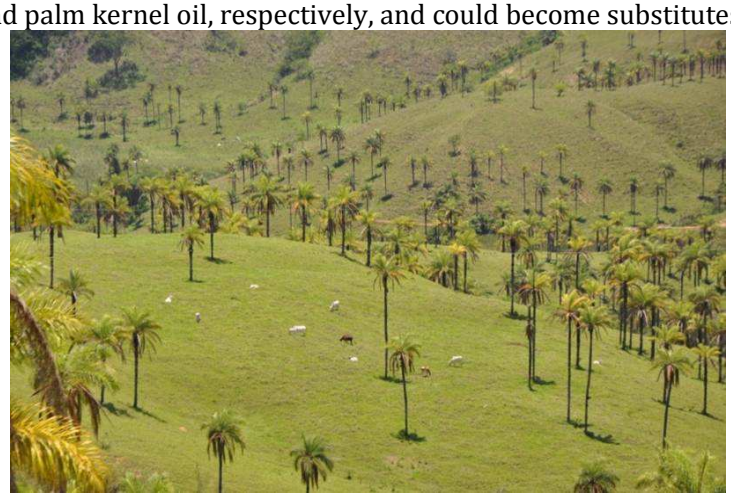
empirically analyze the technical feasibility, economic viability and sustainability of the proposed system.[1]

Macauba (*Acrocomia aculeata*) is a palm tree which

- is native to the Cerrado project region in Brazil (see Picture 3, map on natural occurrence).
- yields at least 30-40kg fruit per palm p.a. (up to 130kg per palm were observed during the feasibility study), which can be processed into plant oil, animal fodder and a dense biomass granulate.
- needs significantly less precipitation than the conventional oil palm (*Elaeis guineensis*) and is resistant to droughts.[2]
- can be integrated into existing pastures without reducing grass yields as demonstrated by the Centro Agronómico Tropical de Investigación y Enseñanza.[3]

Macauba is harvested after coffee providing **additional incomes for workers when seasonal unemployment rates traditionally rise**. Macauba pulp and kernel oil have a similar composition and quality as conventional palm oil and palm kernel oil, respectively, and could become substitutes for those products.

In the Brazilian Cerrado, 500,000km² (= 50million ha) of pastures are available, most of which are suitable for Macauba. **With this approach, oil quantities exceeding the size of today's total global palm oil market can be produced without any impacts on food security or natural ecosystems**.



Picture 2) Agroforestry system with Macauba trees on pasture land

The total financing volume required for the project (debt + equity) amounts to USD 6m. The project will serve as a flagship model, incubating a new industry with significant potential to scale. FIP funding is required to bridge the pioneer gap and establish the silvopastoral Macauba pilot.

[1] The study can be downloaded here: http://www.leuphana.de/fileadmin/user_upload/portale/inkubator/download/Summary_Macauba_Feasibility_Study.pdf.

[2] Fabianie de Gois Aquino et al: Distribuição geográfica das espécies Acrocomia aculeata (Jacq.) lodd. ex Mart. e Caryocar brasiliense cambess. no bioma Cerrado, 2008.

[3] Villanueva et al. (2008): Disponibilidad de Brachiaria brizantha en potreros con diferentes niveles de cobertura arbórea en el trópico subhumedo de Costa Rica., Centro de Agricultura Tropical de investigación y Enseñanza. Turrialba, Costa Rica.

IMPLEMENTATION

The project will include the following two elements:

A. Establishing a **Macauba Training Center**

   i. The Center will train and enable smallholders to increase and diversify their incomes by harvesting the fruits of existing (wild) Macauba palm trees.

   ii. An existing oil mill and storage facilities will be enhanced and upgraded by the Center to process the collected Macauba fruits in order to demonstrate smallholder farmers that Macauba is a profitable business.

   iii. The Center will raise awareness for Macauba products by providing test volumes to companies producing oil based products, animal fodder, and nutshell granulate and thereby prove that there is a market for Macauba.

B. Implementing a **2,000ha agroforestry system** with 300 Macauba trees per hectare as a commercial pilot project

   i. Work with smallholder farmers, who are members of a cattle cooperative, to integrate Macauba palms on their pastures.

   ii. Build up a nursery to provide smallholders with saplings.

Both elements are explained in detail in Chapter V (Business Model).

In year 5, further investment will be attracted to build **a large-scale oil mill** to process fruits from the 2,000ha pilot (these volumes cannot be handled by the oil mill of the Macauba Training Center). This large scale oil mill will be **funded through separate private sector resources and is not part of this proposal**.

EXPECTED OUTCOMES

1. Direct Impact
   a. Establish 2,000 hectare of agroforestry system with Macauba
   b. Sequester 575,000 tons of CO_2 and avoid emissions from deforestation (see next section for details)
   c. Generate income opportunities in periods of high seasonal unemployment
   d. Generate total income of about R$ 28m (>USD13m) for harvest workers and smallholder farmers in the **first 20 years** and over R$ 48m (>USD 22m) when 30 project years are taken into account (see social impact for details)[4]

2. Create a scalable, profitable business
   a. Break-Even after 7 years
   b. Stable annual turnover of minimum USD 4.4m (from year 10)
   c. Stable annual EBITDA of minimum USD 2m (from year 10)
   d. Create positive spill-over effects

[4] Newly planted Macauba palms produce fruits after five years. Each year additional Macauba trees will be planted on pastures. Consequently, total yearly incomes for smallholders and harvest workers increase over time.

II. FIT WITH INVESTMENT CRITERIA

The proposed project addresses *"Theme 1 - Management and use of previously anthropized areas"*, specifically *"1.2- Sustainable production in areas previously converted to agricultural use (based upon the ABC Plan)"* of the FIP investment plan Brazil, which will

"seek to promote sustainable land use and forest management improvement in the Cerrado, the second largest biome in Brazil and South America, contributing to reducing pressure on the remaining forests, reducing GHG emissions and increasing CO2 sequestration".

The goal of the project is to establish a profitable flagship project showcasing the scalable potential of silvopastoral Macauba to sequester carbon and reduce the pressure on existing forests and other important ecosystem hotspots in the Cerrado region. The project will reduce greenhouse gas (GHG) emissions of vegetable oil production (as compared to conventional production models) and promote food security in the Cerrado.

We believe that this proposal merits consideration for investment because

- It tackles major economic, ecologic and social challenges in Brazil and the Cerrado target region, particularly in **hilly regions** that are difficult to access with agricultural machines, leaving extensive cattle farming as the only viable agricultural use of land.
- It fits to FIP targets, the existing framework and the Brazil investment strategy (see below).
- There are significant research efforts on Macauba in the target region: apart from the program at Leuphana University (Germany), there is a strong research network on Macauba involving units of Embrapa and several Brazilian universities as part of the "ProPalma" project.[5]
  Additionally, **Petrobras has invested R$ 5m in Macauba research**. Our project is the first commercial implementation of the Macauba research and serves to **bridge the pioneer gap**.
- There is **strong political support for Macauba** in Minas Gerais: To support the development of pioneer projects, the State of Minas Gerais has implemented the so-called **Pro-Macauba Law** to *"[…] encourage the cultivation, extraction, marketing, and consumption of Macauba products and […] promote the development of Macauba projects, preferably by cooperatives, involving all actors in the supply chain"* (LEI Nº 19.485, 2011).[6]
- It has **enormous potential to be scaled up** in the future: Most existing pastures in the Cerrado are suitable for Macauba, as indicated by large native Macauba stands (see picture 2 above)

Taken together, after successful trials and several feasibility studies conducted by universities, the prerequisites for a successful project are given. A first-mover is required to implement the first large-scale project to leverage the industry. An FIP investment will establish an important landmark project with significant spillover effects and scalable positive impact.

[5] Embrapa, 2012 (http://www.embrapa.br/imprensa/noticias/2012/agosto/3a-semana/macauba-no-mercado-de-bioenergia/).
[6] LEI Nº 19.485, 2011. http://www.agenciaminas.mg.gov.br/noticias/governo-de-minas-regulamenta-o-pro-macauba/.

- **Additionally**

  This project is unlikely to be financed without the FIP Program. The Macauba industry suffers from the **pioneer gap**: In spite of the extensive research described above and despite the ProMacauba Law established in 2011, there is still not a single Macauba pilot project.

  Currently, innovative vegetable oil projects with novel species suffer from hesitating private investors. Among the reasons for **investors' reluctance to invest in oil-bearing perennials** are – amongst others – **negative experiences with Jatropha**. Worldwide, over 200 million dollars have been invested in Jatropha projects – many of which failed to yield the expected oil volumes and hence showed negative financial returns. Lack of agronomic knowledge on the plant was one of the main issues, why so many projects failed.[7] This is not the case for Macauba because of the intense and regionally focused research on the plant. As the 2,000 hectares of Macauba agroforestry systems will be planted exactly in the area where the research has been conducted and thousands of wild Macaubas can be found, knowledge is transferable – which was often not the case in Jatropha projects.

  Yet, pioneering investment is very unlikely to be done by private investors alone. As trees of a novel species can not serve as an asset, **financial risk mitigation via collaterals is difficult** to achieve. One solution would be to acquire land, which however contradicts the objective to maximize positive social impacts. Therefore, concessional finance is needed to reduce risks for private investors. Reducing asset-backing burdens via FIP financing will help the project to fully focus on scale and impact.

  Furthermore, as the first project of its kind, investment in capacity building and training will be significantly higher than for subsequent projects. This has proven to be an investment barrier for classic investors. FIP funding and technical assistance will help to overcome this barrier. Our project will be able to develop best practices for establishing silvopastoral systems with smallholder farmers, which can be applied by future projects. Reducing uncertainty, this will facilitate future projects to access conventional financing.

  Due to the significant investments in capacity building and the time difference between planting and first harvest, the project would not be viable without relatively low interest rates. At last, our rigorous triple-bottom-line approach is only possible with below market interest payments.

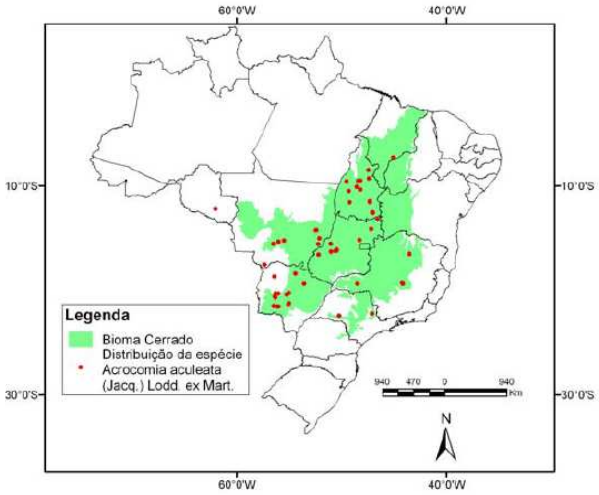
- **Climate Change Mitigation Potential**
  - Baseline: pastures remain unchanged
  - Leakage: according to the UNFCCC approved afforestation and reforestation baseline and monitoring methodology,[8] leakage from establishing silvopastoral systems on pure grassland can be counted as zero.
  - Carbon storage: according to Toledo et al., Universidade Federal de Viçosa, the average CO_2 sequestered in each Macauba palm amounts to 958 kg per tree; accordingly the

[7] See Leuphana University (2013) Insights into Jatropha Projects Worldwide (http://www.leuphana.de/fileadmin/user_upload/portale/inkubator/download/Studie_Insights_into_Jatropha_Projects_Worldwide.pdf).
[8] United Nations Framework Convention on Climate Change (2012): AR-AM0009.

total carbon storage of 2,000ha with 300 trees per hectare amounts to 575,000 tons of CO_2.

- **Indirect effects** comprise reduced pressure on existing forests: planting Macauba generates higher incomes for local farmers and creates additional job opportunities. Rather than cutting down forests in order to increase pasture sizes and hence incomes, local farmers could participate in the vegetable oil business and benefit from its higher returns.

- **Demonstration of potential at scale**
  Pastures cover 50m hectares of the Brazilian Cerrado. Macauba is already native to most parts of the Cerrado and could be cultivated in the entire region (see picture). The business model is economically viable and can be scaled up working with further cooperatives, as well as industrial cattle farmers. In the project region of Patos de Minas alone, 594.000 ha of pastures are available. [9]



Picture 3) Natural occurrence of Macauba

  In the medium term, it seems realistic to substitute the entire Brazilian palm oil imports. These imports are currently about 200,000 tons p.a. [10] and the country's import dependency is rising - a fact, the Brazilian government currently seeks to reduce.[11] About 200,000 ha of silvopastoral Macauba plantation are required to cut Brazil's palm oil imports to zero. Achieving this plantation size within 20 years seems to be realistic since:

  - With Coopatos as a partner, **up to 98,000 ha** of pastures can be accessed without requiring any changes in partnerships and communication channel.
  - Coopatos owns 51% of Cemil, a cooperative of cooperatives, making a further scale-up of the model realistic.
  - Additional cooperatives such as CARTEC have already been contacted and expressed interest in silvopastoral Macauba plantations.
  - The Macauba Training Center will reach out to farmers and harvest workers not associated with Coopatos and also invite NGOs and cooperatives to present the opportunities arising from Macauba collection.

  Potential long term impact: With over 50m ha of Cerrado pastures potentially suitable for silvopastoral systems with Macauba, the long-term Macauba potential in Brazil exceeds the current global palm oil production volume. This potential can be realized by leveraging an innovative afforestation method – as opposed to deforestation for monocultures. The

[9] Source: Official cattle statistics, State of Minas Gerais.
[10] Source: index mundi, U.S. Department of Agriculture.
[11] To encourage the substitution for imported palm oil, the government has established the "ProPalma" Program and palm oil is subject to import duties.

approach is economically viable with smallholder integration in training, employment and income diversification.

In summary, national market demand for palm oil is high and the government promotes the production of local palm oil equivalents. The production potential is equally high and 200,000 hectares of silvopastoral systems could be achieved within two decades with further expansion potential in the long run.

- **Cost Effectiveness**
  The FIP funding is likely to trigger relevant private sector investments in assets such as oil mills as well as in additional projects. Furthermore, since a majority of preparatory and supporting research was funded through the EU-project at Leuphana University Luneburg and other universities, the additional investments will directly be applied to the actual implementation of the Macauba flagship project, rather than further research and development. While the expected **direct** GHG reduction during the life of the program per FIP dollar invested amounts to 5 USD/ ton of CO_2, indirect effects are significantly more pronounced: planting Macauba increases incomes per hectare of land for smallholders and hence reduces pressure to log remaining forests. While palm oil plantation frequently resulted in rainforest destruction in the past, Macauba oil can serve as a deforestation-free substitute.

- **Implementation Potential**
  The implementation will be conducted in cooperation with the local milk cooperative "Coopatos", whose members manage a total of 98,000 hectares of pasture land (further information on www.coopatos.com.br). Building upon the established communication and governance structures within the cooperative, the project will be able to achieve a large social impact with a high implementation feasibility.

- **Safeguarding the Integrity of National Forests**
  Macauba palm trees will be integrated only on existing pastures, hence safeguarding the integrity of national forests. Moreover, planting Macauba trees allows mitigating some of the impacts of deforestation: Clearing forests affects wind velocity and changes in temperature and rainfall patterns. Tree canopies block the sun's rays over the day and hold in heat at night. When entire areas are deforested, this leads to more extreme temperature swings that can be harmful to plants and animals. While rainfall is significantly higher over the warmer, deforested land, rainfall over the remaining forests can be reduced by 50% or more.[12] Therefore, changing land use from forest to cropland reduces rainfall over neighboring forests threatening those remaining ecosystems. Integrating Macauba palm trees into pastures creates a canopy cover of approximately 30%, hence reducing the amplitude of temperature swings by providing shade. Moreover, even dispersed trees act as windbreaks and sequester carbon. For this reason, agroforestry systems with pastures (silvopastoral systems) have been accepted as afforestation and reforestation activity by the UNFCCC.

  Moreover, Macauba silvopastoral systems can substitute for palm oil plantations which have been established at the expense of rainforests in the past. Average yields of palm oil

[12] NERC (2011), NASA (2004).

plantation amount to 3.5 tons of oil per hectare[13] while silvopastoral Macauba plantations yield about one ton of oil. Consequently, 200,000 hectares of Macauba agroforestry could substitute over 55,000 hectares of palm oil plantation – potentially saving the same amount of rain forest.

- **Integrating Sustainable Development (Co-Benefits)**
  - *Environmental effects:*
    As described above, planting Macauba trees can mitigate the effects of deforestation and increase carbon sequestration. By providing shade, Macauba trees can also reduce the water consumption of cattle. As a native species, Macauba trees increase **biodiversity**, providing food and shelter for animals.

Picture 4) Biodiversity: Macauba as a habitat

  - *Social effects:*
    More than 200,000 people in Minas Gerais work on coffee farms during the harvest season. After the coffee season, unemployment rates generally rise. As Macauba harvest takes place from October to January, i. e. after the coffee harvest, it creates well-paid additional income opportunities for workers. Growing Macauba increases incomes for smallholder farmers and hence local taxes. Workers in the feasibility study earned on average R$ 73 per day i.e. R$ 1600 per month[14] with harvesting native Macauba stands. This is equivalent to more than twice the monthly minimum wage in 2012. When all planted Macauba trees reach maturity,[15] the project will create 250-350 of those jobs from October to January reducing seasonal unemployment outside the coffee harvest peaks.

    Over the period of 20 years, harvest will amount to about 300,000 tons of fruits which yields about R$ 18m (> USD 8m) to workers. When 30 project years are taken into consideration, this amount increases around 500,000 tons yielding approximately R$ 32m (USD 15m[16]).

    Moreover, smallholder farmers who plant Macauba will receive a "Macauba land lease" depending on the fruit yield per hectare (on average about R$ 300/ hectare). Smallholders can hence decide whether they want to organize the harvest themselves or receive a compensation for the volumes harvested. In total, "land lease" payments to smallholder farmers will amount to about R$ 10m (> USD 4.5m) over the first 20 years and R$ 16m (> USD 7.5m) over a projected period of 30 years.

    In total, **smallholder farmers and harvest workers** will earn about R$ 28m (>USD 13m) in the first 20 years and more than R$ 48m (> USD 22m) in the first 30.

    These calculations do not yet include revenues for the project management team, nursery staff and extension service (9 FTE), as well as truck drivers. The oil mill, which will be funded by the private sector, also creates additional income opportunities.

[13] Source: Round Table on Sustainable Palm Oil.
[14] Calculation based on 22 working days.
[15] The first newly planted Macauba palms will reach maturity in year 5, the last palms in year 10.
[16] Exchange rate June 2013, please note that exchange rates are strongly fluctuating.

– *Systemic impact:*
Establishing 200,000 hectares of silvopastoral system would allow for a significant substitution of Brazilian palm oil imports and is a realistic development target in the next decades. Such a plantation size would require 25,000-30,000 harvest workers and generate income opportunities for several thousands of smallholder farmers.

III. Type of Private Sector Engagement

The project is a fully private initiative. The project is based on a cooperation between **INOCAS** GmbH, Luneburg, Germany, and the **cooperative Coopatos**. Coopatos members are smallholder milk producers with 60 ha of pasture land on average.

The project benefits from publicly funded research such as the research project at the Leuphana University Luneburg.

IV. Innovation

The project's main innovative component is its business model, which has not been applied anywhere in this form yet. Agroforestry systems as such are not new by themselves. Yet typically, the product in the forestry part of the system is timber. In our model, the Macauba trees are not planted to harvest wood, but to create another set of marketable products (Macauba oil, animal fodder, granulate) with the following advantages:

- Compared to other contract farming models, risk exposure of smallholders is significantly reduced. Farmers do not have to cover material costs for plantations bu t only contribute labor to establish and maintain the Macauba trees. Monetary expenses are covered by the project venture. This is one of the reasons, why the proposed project requires concessional financing.

- Many projects involving planting of trees fail because smallholders fear that no company will be there to buy their products in a few years time. For this reason, it is vital and also an innovative element of our model to have a processing facility available right from the start of the project (in the Macauba Training Center, see below). This way, we actively demonstrate the existence of a market for the smallholders' products. Past experiences show that neglecting this crucial psychological factor often leads to significant failures in introducing additional crops to traditional family farmer structures (see for example the experiences with Castor in Brazil).
- In the past, there was limited knowledge about the processing of Macauba in Brazil. However, Paradigma Oleos Vegetais has developed an innovative system to process Macauba Oils and the valuable by-products and serves as a blueprint for larger scale facilities.

V. Technology, Product, and/or Business Model

The project uses a technology developed by the local partner in Brazil and will establish a pilot for a full Macauba value chain in the project region. The project covers the following elements:

1. Harvesting and processing of Macauba fruits and marketing of products (performed by the Macauba Training Center)
2. Establishing of a 2,000ha Macauba agroforestry system (including sapling production)

1. Harvesting and processing of Macauba fruit

The harvest of fruit from existing Macauba trees is organized by harvest workers who typically work in coffee until July/ August. The Macauba fruit bunches are cut with knives fitted on long sticks and collected in big bags, which are then transported by tractors and loaded on trucks (see pictures). As stated above, the 2012/2013 Leuphana feasibility study (300t harvested) found that harvest workers earned above twice the national minimum wage.

Fruits are collected in big bags… | *…which are taken by tractors either to trucks…* | *…or next to the road (& picked up by trucks later)…* | *…bags are unloaded at the oil mill.*

Picture 5) Macauba harvesting process

For processing, Macauba fruits will be dried in a dryer fueled with wood. After drying, the outer shell and pulp are separated from the harder, inner shell ("endocarp"). The pulp will be pressed to gain pulp oil and pulp press cake. The endocarp will be crushed to separate the soft kernel from its hard shell (see picture). The inner kernel is then further processed into kernel oil and kernel press cake. The endocarp shell is processed into a high-quality granulate. For all products, local markets are available (see below). Companies indicated their interests and/or signed letters of intent for the purchase of the full product spectrum.

Fruits after drying | *Separation of dried fruits* | *The oil press*

The Macauba oil mill in the pictures is run by Paradigma and was used during the Leuphana University feasibility study.

Picture 6) Processing of Macauba Fruits

2. *Establishing of a 2,000ha Macauba agroforestry system (incl. sapling production)*

Small plants are either produced from Macauba seeds or collected as wild growing small plants. They will remain in a nursery for 6 to 18 months until they reach the necessary height (ideally >

1m) to be transplanted into the field. The nursery will provide the plants for the smallholder farmers.

The silvopastoral system will be established in cooperation with Coopatos, a local milk cooperative, which will help to address cattle farmers in the region. Coopatos members have 98,000 hectares of pasture land under management. Those participating in the project will be compensated if losses resulting from reduced land availability in the first years after planting Macauba trees occur. Availability of the land for cattle may be reduced for an initial period of 24 months, because newly planted palms need to be protected from cattle, for example by fences, until they reach a sufficient height.

As described above, farmers will not have to pay for saplings or other material cost, but only contribute labor. The 2,000 ha will be established step by step over a four-year period.

As soon as the Macauba trees bear fruit, the project will either

1. harvest the Macauba fruits on the farmers' land paying farmers a certain price per kg harvested,
2. or purchase harvested and collected fruits for a higher price from the farmers

The cooperative Coopatos will contribute logistical support. To assist farmers with growing and maintenance of Macauba, the project venture will provide an extension service, and agronomists will visit farmers on a regular basis.

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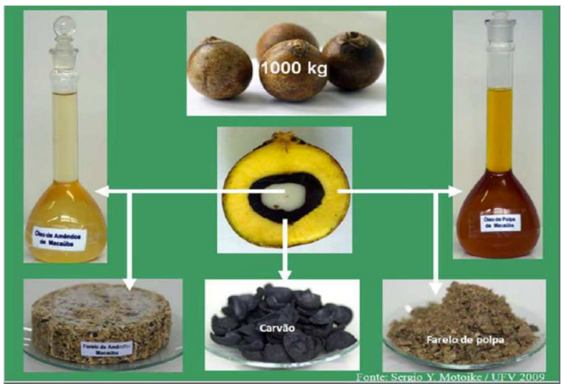
VI. Market

Macauba fruits are processed into

i. Oil: pulp oil and kernel oil
ii. Animal fodder: pulp and kernel press cake
iii. Granulate gained from processing the endocarp.



Picture 7) Macauba Fruit and its Components

I) MACAUBA PULP AND KERNEL OIL

Macauba fruits contain about 10% of oil. The oil gained from the outer pulp is comparable to palm oil, the oil from the inner kernel is comparable to palm kernel oil. Palm and palm kernel oil imports to Brazil increased at a rate of 13% and 24% p. a, on average over the last 10 years, respectively. In 2012 net palm oil imports into Brazil reached about 200,000 tons, net palm kernel imports 385,000 tons. According to the Brazilian Secretariat for Social Communication the imported palm and palm kernel oils are used in chemicals as well as a raw material in soaps, shampoos and detergents.[17] In

[17] SECOM, 2013 (http://www.brasil.gov.br/para/press/press-releases/may/brazil-launches-national-program-for-environmentally-sustainable-palm-oil-production/br_model1?set_language=en).

addition to those products, Macauba oil is suitable for biodiesel production. In the context of this project, the first volumes of Macauba oil produced will be sold to a local oleochemical company.

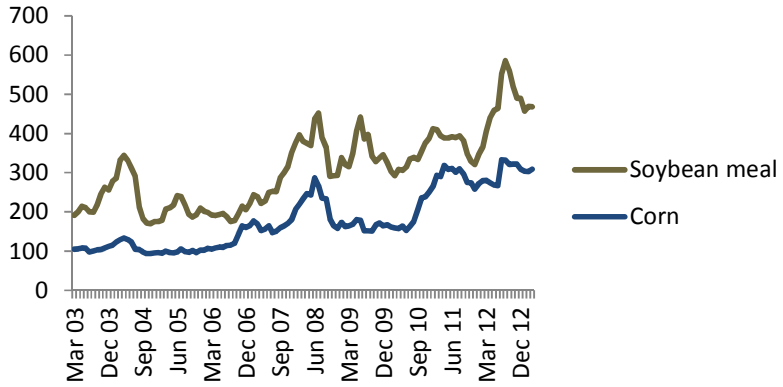
In the long run, Macauba oil is also suitable as biodiesel feedstock promoted by the Brazilian Social Fuel Seal Program (Selo Combustíve Social), which aims at integrating smallholder farmers in biodiesel feedstock production. The criteria defined by the seal are fulfilled by the cooperative. Prices of Macauba are likely to be linked to palm (soap and oleochemicals) or soybean oil (biodiesel) depending on the market.

II) ANIMAL FODDER

After the oils are extracted from the fruit, the remaining press cake represents a valuable cattle fodder containing fiber and proteins. Macauba fruits are already used to feed cattle by some farmers. Due to Brazil's growing meat and milk demand, volumes required to feed the country's herd are continuously increasing. Domestic soybean meal use, dedicated to fodder production, increased from 10m tons in 2002 to 17m tons in 2012. Again, Macauba can help to meet growing national demand.

While being used by some farmers, Macauba press cake is not known as a fodder ingredient by large fodder producers. This represents a market barrier. Like for the oil, the project will first produce smaller amounts of press cake. Collecting and processing fruits from existing wild Macauba palms, cooperatives and other large scale fodder producers can test Macauba-containing fodder in trials of several thousand tons. In year 5 of the project, when large volumes of Macauba fruits become available, fodder producers will be more familiar with the product.

Animal Fodder Prices (Soybean Meal and Corn) 2003-2013 [USD]



Prices: Soybean meal and corn prices which are relevant fodder components have more than doubled over the past decade and are expected to rise in the future.

Source: index mundi, U.S. Department of Agriculture

III) GRANULATE

Grinded endocarp can be used as raw material oil drilling activities, for activated carbon production, for the sandblasting industry, and, due to a comparatively high caloric value, as fuel.

VII. Financial Plan (Indicative)

The required financing of a total of USD 6m will serve to set up

a) The Macauba Training Center including an upgrade of the existing oil mill for the processing of approximately 1,500t of wild growing Macauba fruit p.a. and
b) A 2,000 ha silvopastoral system.

The following table presents a split of the subcomponents of the project (in terms of main expense items in the first six years of the project), and the assumed sources of financing for these components. Please note that all numbers are calculated in Brazilian Real and then converted into US Dollar at an exchange rate of 0,44 (July 24, 2013[18]). These numbers can serve as an indication for how and where funds will be applied. Actual required financing volume might differ as certain revenues are not considered here. Also, due to strong fluctuations in exchange rates in 2013, the US Dollar amount can differ from the USD 6.0m indicated above (at present: USD 5.9m)

A) Macauba Training Center	**In '000 R$**	**In '000 USD**	**Financing Source**
Investment in assets	250	111	Debt (FIP) + equity
Training & Support	400	178	MIF Grant
Subtotal	**650**	**289**	
B) 2,000 ha agroforestry system			
Planting (largest cost factors: nursery, fertilizers, protection of saplings)	7,500	3,336	Debt (FIP) + equity
Extension Service	1,700	756	MIF Grant
Others (largest cost factors: working capital, management, vehicles, etc.)	3,400	1,513	Debt (FIP)+ equity
Subtotal 2,000 ha agroforestry	**12,600**	**5,605**	
Total	**13,250**	**5,894**	

The project has a total revenue potential of about USD 5m which can be reached after 10 years. In the first 5 years, revenues will stay at a relatively modest level of approximately USD 0.5m. During that time, incomes are mainly created by the Macauba Training Center. As Macauba takes 4-5 years until the first harvest is possible, revenues of the plantation component will only kick-in after that time. The project will operationally break-even in year 7 and create a stable cash flows (before financing) exceeding USD 1 m after year 10. The Internal Rate of Return (IRR) based on cash flows before financing is negative for a 10 year horizon, about 10% over 15 years and 15% over 20 years. This demonstrates the very long term character of the investment.

[18] Exchange rate 24th July 2013, Source: oanda.com.

These financial projections assume a concessional financing component by the IADB (MIF grant and FIP loan) as shown in the table below:

Source of Funding (by type of instrument, equity, debt, guarantee, grants, credit lines, etc.)	**Amount (USD million equivalent)**	**Percentage (%)**
Project developer	USD 2m	35
MIF grant (in USD)	USD 1m	15
FIP loan (in local currency via financial intermediary)	USD 3m	50
Local banks	0	0
Other investors	0	0
Bilaterals	0	0
Others	0	0
TOTAL	USD 6m	100

As described in chapter II, the project requires concessional finance for several reasons:

- Establishing this pilot value chain in the project region requires efforts, specifically for training and support of local farmers and harvest workers to become familiarized with the activities around Macauba. This will not be needed as extensively for other projects once the pilot is established. This upfront investment to establish the value chain would not be financeable on commercial terms.
- Macauba is a plant not yet cultivated in Brazil and is thus also new to the financing community. This entails that commercial financing, specifically bank loans, are not yet available for Macauba
- Due to long lead times until the first harvest of Macauba, financing needs to be long term oriented (> 15 years horizon).
- As this is the first commercial stage project, financiers have to bear specific "piloting" or "first mover" risks. This typically implies that commercial bank loans are not available.

VIII. Expected Results and Indicators

Results	**Indicators**
<u>General</u>	
Successful flagship project: substantial increase of # of Macauba palm trees planted in agro-forestry systems	# of plants under management # of hectares under management

Concept of planting Macauba in agro-forestry systems is taken up by significant number of smallholder farmers	# of smallholder farmers planting Macauba
Economic	
Successful demonstration of economic potential: project is financially profitable	EAT and IRR
Successful flagship project: expansion of market for Macauba based products	Sales figures as well as types of different markets and products
Reduction of regional unemployment	Number of jobs created (both direct and indirect)
Environmental	
Climate change mitigation: CO_2 sequestration (see III, "Consistency with Investment Criteria")	Tons of CO_2 sequestered through planting Macauba trees
Climate change mitigation: partial substitution of fossil fuels through sustainably produced Macauba oil based biofuels	Tons of vegetable oil produced (which could be turned into x tons of biofuel)
Social	
Significant increase of (small-holder) farmers' incomes	Average farmer's income
Diversification of (small-holder) farmers' incomes	Composition of average farmer's income
Significant increase of land-workers' incomes	Average land worker's income
Creation of new job opportunities for land-workers (especially outside the coffee harvesting season)	Average land worker's income in Macauba harvesting season (in comparison to the activities traditionally carried out during this part of the year)

IX. Implementation Feasibility and Arrangements

As described above, the project benefits from a low-tech approach. Together with the business model structure, that specifically incorporates smallholders' concerns and risk sensitivity, the project shows a high implementation feasibility.

The Macauba Training Center is ready to start in the next Macauba harvesting season. i.e. by October 2014. The establishment of nurseries for the agroforestry system can be started in parallel. Thus, plantation can start at the beginning of the wet season in October 2015. According to the plan, the 2,000 ha will be established over a period of 4 years:

- 2015: 250 ha
- 2016: 400 ha
- 2017: 600 ha

- 2018: 750 ha

The first collection of Macauba fruits from the planted trees is expected from 2019 onwards.

Expected FIP Sub-Committee approval March 2014
Expected MDB Approval date: April 2014

X. Potential Risks and Mitigation Measures

Risk	Mitigation Measure
<u>Market side</u> Market for vegetable oil and related products fairly volatile Unproven and not very well known product Reputational: "palm oil" under criticism	 Model assumes very conservative figures for product prices Feasibility study has shown that offtakers exist and are willing to purchase produced volumes, additionally Macauba oil is very similar to other well-established vegetable oils Macauba is different from the African oil palm. It represents a sustainable alternative and thus provides an effective means to reduce palm oil driven deforestation. This argument is highly communicable.
<u>Political</u> Carbon credit market may evolve badly (due to political decisions, notably in the EU)	 Addressing specific sub-segments on the **voluntary carbon market** (carbon credits for silvopastoral systems), cooperation with carbon credit experts
<u>Stakeholder-related</u> Smallholder farmers traditionally see Macauba as a burden, since there was no income generating activity associated with it so far	 Financial benefits to smallholders have been demonstrated in the feasibility study (with >300t harvested in the region) → the word about the additional income opportunities from Macauba is spreading; furthermore, additional trust due to collaboration with local cooperative
<u>Biologic</u> Macauba plant has not been optimized yet, so yields may vary Surrounding Brachiaria grass could slow down growth of Macauba palm trees and accordingly push back first revenues from selling to > 4years after planting	 Ongoing research at Brazilian universities and institutes to improve plant efficiency; estimates in business model are conservative and use values (such as kg of fruits per palm tree) gained from analyzing wild Macauba in the project region Ongoing research to optimize planting process
<u>Manufacturing</u>	

Current oil mill not latest technology; may slow down scaling process	Built-out investments in oil mill budgeted in business plan
<u>Financial</u> Cash flow: significant investment needed in to establish agro-forestry system, then palm trees need to grow for 4 years before first income from the agro-forestry system Access to finance: First mover difficulties Exchange rate risks: the Brazilian Real shows significant fluctuations in exchange rates in 2012-2013	Revenue from day 0 onwards due to harvesting wild Macauba and selling oil produced from its fruits, using the already existing oil mill Seeking funding from development banks which have more than just one bottom-line and play vital role in helping close the pioneer gap. Achieving debt funding in local currency, Making off take prices depending on price indices

XI. Contact

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