“Determinants of DMC technologies adoption among smallholders in the Lake Alaotra area, Madagascar”

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Outline

A/ Agrarian context of the lake Alaotra and BV Lac project presentation

B/ Evolution of the extension of DMC technologies and first economic results

C/ Highlight on the methodology developed by the project

   C1/ Territorial approach

   C2/ Farming systems approach (technico-economic modeling)

D/ Conclusion
A/ Agrarian context of the lake Alaotra and BVLac project presentation
Lac Alaotra – localisation

- Located at 250 km North East of Antananarivo, 640 000 inhabitants including 540 000 farmers (85 %)
- With 100 000 ha of cultivated plains, it is considered to be the Madagascar’s “rice granary” (300 000 T of paddy rice/year)
- Important area of migration with a population doubling every two decades ….
- More than 60 % of the rural population is considered as smallholders
A/ Agrarian context

- Plains: 100,000 ha, distributed between 30,000 ha of irrigated perimeters and 70,000 ha of rainfed lowlands
- 7,000 Km² of watershed, with marked erosion features
- Saturation of the lowlands / cultivation of the hills has become essential for many farmers…
### The main cropping systems on the hills

<table>
<thead>
<tr>
<th>Month</th>
<th>Upland rice</th>
<th>Maize</th>
<th>Cassava</th>
</tr>
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<tbody>
<tr>
<td>Nov.</td>
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<td>Dec.</td>
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<td>Mars</td>
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<td>Avril</td>
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<td>Mai</td>
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<td>Aout</td>
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</tbody>
</table>

1/ **Upland rice** → **bare soil**  
2/ **Maize** → **bare soil**  
3/ **Cassava** → **monoculture**

- High technical and economic randomization + soil degradation
- Irregular and decreasing profit margins
- Erosion
Main cropping systems on rainfed lowlands

Highlights on traditional management

- Climatic hazard
- Important rains
- Important rains

Nursery sowing

Transplant.  Photosensitives varieties

Flowering  Harvest

Uncertainties as regards the date of transplantation or sowing

Uncertainties as regards the retreat of the Water lame
Consequences of erosion
Traditional upland rice cultivation
Lavakas

Siltation
« Lavaka’s » development upstream of the irrigated perimeters
Damages in irrigated perimeters.....
Breaking dike...
The « projet de mise en valeur et protection des Bassins Versants du Lac Alaotra »

(1) Improving the incomes of local populations

(2) Avoiding natural resource degradation in order to secure important irrigation infrastructures on the lower side of the watersheds

(3) Strengthening the capacity of farmers’ organisations and local collectivities to become responsible for their own development
Interests of DMC technologies in the context of the lake Alaotra....
Main challenges related to DMC technologies in the Lake Alaotra area: improvement of the smallholders’ incomes on the hills

An important technical referential has been created by CIRAD in order to produce cash crops on the hills.
Main challenges related to DMC technologies in the Lake Alaotra area: Integration « agriculture-livestock »

Stable crops in association with forage, providing quality pastures to smallholders....
Main challenges related to DMC technologies in the Lake Alaotra area:

**The rainfed lowlands**

Use of SEBOTA varieties which can be cultivated in irrigated, rainfed and/or upland conditions.

Important challenges at the provincial and national scales...
Main challenges related to DMC technologies in the Lake Alaotra area:

**Environmental preservation**

Development of forage cover crops on the hills (*Brachiaria sp*) for erosion control...
B/ Evolution of the extension of DMC technologies and first economic results
Evolution of the extension of DMC technologies (BRL, BVLAC, 2007)

- Surf (Ha)
  - Hills
  - rainfed lowland
  - Nb adoptants

- Nb farmers

<table>
<thead>
<tr>
<th>Period</th>
<th>Hills</th>
<th>rainfed lowland</th>
<th>Nb adoptants</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003 - 2004</td>
<td>51</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>2004 - 2005</td>
<td>101</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td>2005 - 2006</td>
<td>169</td>
<td>164</td>
<td></td>
</tr>
<tr>
<td>2006 - 2007</td>
<td>253</td>
<td>181</td>
<td></td>
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<tr>
<td>2007-2008</td>
<td>334</td>
<td>274</td>
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</table>

First economic results....

Relation between labour productivity and the number of years of DMC practices
(BRL Madagascar, 2007)

LP ($/J/ha)

2500 plots (rice, maize, legumes and cassava based cropping systems)

[LP = (Gross Product-inputs)/ nb days work]
Disaggregation of the Labour Productivity
(Maize based cropping systems, 435 plots, BRL Madagascar, 2007)
Durability of the adoption

Evolution of the abandon rate

Important abandon rate at the begining of the project
Progressive decrease: (1) training, (2) simplification of the C.S., (3) qualitative approach at territory and farming system scale

Other reasons
Credits refund
Agriculture works organisation
Land access
Level of investment
Technical problems
C/ Highlight on the methodology developed by the project
C1/ An holistic approach for a sustainable development....
C1/ Socio-territorial approach

- 100 farmers organisations, involving some 1000 farmers
- Access to bank credit: about 150 000 $ in 2007
- Land access: 400 land certificates were delivered in 2006…
- Market access: production contracts with private companies (rice and maize sectors)
- Improvement of forage availability and erosion control at the village scale
### C/2 Farming systems typology (BVLAC, 2007)

**Type A : « Rice producers »**

<table>
<thead>
<tr>
<th>TYPES</th>
<th>Total area</th>
<th>Rice self sufficiency</th>
<th>Livestock production</th>
<th>Off farm activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>TA &gt; 9 ha</td>
<td>Self sufficient</td>
<td>Bovine</td>
<td>No</td>
</tr>
</tbody>
</table>

**Type B : « Rice producers with irregular yields »**

| A     | TA > 7 ha  | Self sufficient         | Bovine               | No                  |

**Type C : « Self-sufficient farmers cultivating the hills »**

| C     | TA < 5 ha  | Self sufficient         | Bovine, pig, poultry | Commerce, handicrafts |

**Type D : « Self-sufficient farmers with diversified productions »**

| D     | TA < 3.5 ha| Self sufficient         | Pig, poultry         | Commerce, farm worker |

**Type E : « non self-sufficient farmers and agricultural workers »**

| E     | TA < 1.5 ha| No                     | Poultry              | Farm worker          |

**Type F : « non self-sufficient farmers and fishers »**

Tools: software Winstat / Olympe
• Two groups A and B with high investment capacities but different strategies: (A) securised rice production; (B) risky production

• Types C,D,E: Diversification / integration with livestock / off farm activities / diverse investment capacities

• Type F: livelihood systems orientated towards fisheries (66%)
### C/2 Technical proposals in function of the farming systems types

<table>
<thead>
<tr>
<th>Type</th>
<th>Interests</th>
<th>Constraints</th>
<th>Technical proposals</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (3)</td>
<td>Forage availability</td>
<td>Prioritisation of the ricefield activities</td>
<td>Forage-based cropping systems / flexibility of the cultural calendar</td>
</tr>
<tr>
<td></td>
<td>Diversified productions</td>
<td></td>
<td></td>
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<tr>
<td>B (1)</td>
<td>Securisation of the income provided by the rainfed lowland and the hills</td>
<td>Ø</td>
<td>All the cropping systems / integration of the mecanisation (heavy)</td>
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<tr>
<td>C (1)</td>
<td>Securisation of the income on the hills</td>
<td>Ø</td>
<td>Diversified rotational sequences / integration « agriculture-livestock » ;</td>
</tr>
<tr>
<td></td>
<td>Integration with livestock (cattle and pig)</td>
<td></td>
<td>high level of intensification possible</td>
</tr>
<tr>
<td>D (1)</td>
<td>Securisation of the income on the hills</td>
<td>Risk</td>
<td>Diversified rotational sequences / intégration « agriculture-livestock » ;</td>
</tr>
<tr>
<td></td>
<td>Integration with livestock (pig, poultry)</td>
<td></td>
<td>different levels of intensification following investment capacities</td>
</tr>
<tr>
<td>E (2)</td>
<td>Ploughing removal</td>
<td>Risk</td>
<td>Cropping systems without chemical inputs</td>
</tr>
<tr>
<td></td>
<td>Improvement of the incomes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F (3)</td>
<td>Additional incomes</td>
<td>Livelihood systems</td>
<td>All the cropping systems</td>
</tr>
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<td>Reconversion in agriculture</td>
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</table>

1. **High propensity to adopt DMC technics**
2. **Interests but some constraints can retrain the adoption**
3. **Few interests and/or important adoption constraints**
Some examples: farmers of type A...
Some examples: farmers of type C...

Hills
- Peanuts
- Maize + legumes

Rainfed lowland
- Upland rice

Production of cash crops on the hills and rainfed lowlands / pig fattening

Aromatic rice (SEBOTA)
Small mechanisation
Some examples: farmers of type E...

« Ecobuage »

Stylosanthes based cropping systems
The extension of DMC technologies become significant in the region of the Lake Alaotra.

The training is necessary but not sufficient: the adoption determinants have to be considered at territory and farming systems scales.

The degree of adoption can vary depending on (1) the advantages found by each farms categories in the systems proposed, and (2) the ability to implement these new technologies.

The South-East of Asea context is different: possibility of developing an approach crossing regions/territories with sectors of intervention.

Experience has shown that changes in crop management sequences are often more difficult in traditional, self-subsistence agriculture situations…
Thank you for your kind attention