ENVIRONMENTAL AND SOCIAL-ECONOMIC IMPACTS: THE STAKES AND THE SOLUTIONS ON ROUTE RN6 PROJECT IN MADAGASCAR

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ABSTRACT

For the last four years, with support from international financial backers and local companies, the Malagasy government has focused on improving its road network, as a means to enhance the country's rapid, sustainable development policy. In this way, work has been done on roughly 6,000 kilometers.

In parallel to this increase in road works projects, new requirements in terms of quality, safety and environment on work sites have been set by the Public Works Minister.

Colas, a company that has been operating in Madagascar since 1950, now has the ways and means to meet this challenge. As a socially-minded company, Colas set up programs on its largest project currently underway in order to limit and prevent the environmental and social impact of its operations by: :
- reducing pollution, recycling, optimizing natural resources, reforestation, using alternative resources such as natural gas;
- creating base camps for workers with running water and electricity along with a free clinic run by a skilled doctor, launching campaigns on sexually-transmitted diseases, infections and malaria.

1. BACKGROUND AND STAKES

The project presented in this paper involves a 310-km section on National Route 6 (RN 6) between the towns of Port-Bergé and Ambanja in the north-east of Madagascar, the only link between the capital city Antananarivo and the main city in the north Diego-Suarez.

RN 6 is made up of 158 km of roadway that is currently paved or had once been paved, showing different degrees of damage, along with 152 km of dirt road that become untraffickable during the rainy season (5 months per year).

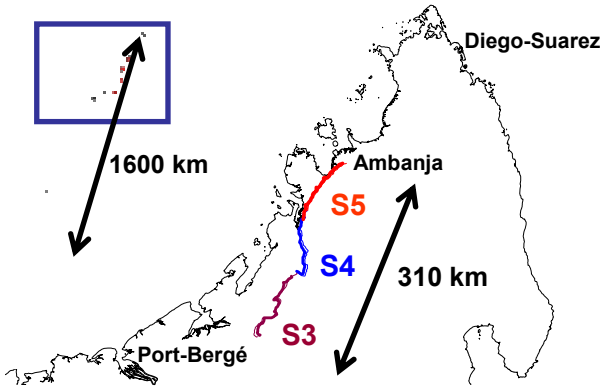

Figure 1 – Location of project

Slated to last 44 months, the 100 million-euro project is financed by the European Development Fund and consists in earthworks (> 2 million m^3), road building (> 1.6 million t crushed aggregates) and roughly one thousand hydraulic structures.

The project, which is exceptional in size both for Madagascar and the Colas Malagasy subsidiary as well, required the roll out of major resources, both in terms of people and

equipment, along with a rigorous organization to prevent and limit environmental and social impact that could come from the work.

The biological and physical characteristics of the project are as follows:

According to the environmental impact assessment carried out by the World Wildlife Fund (WWF) [1], the Port-Bergé – Antsohihy section, 109 km in length, is home to 27 endangered species (fragile, in danger, threatened, endemic and/or regional endemic). This number includes reptiles, birds and mammals such as primates. It is also important to note that there are roughly ten rivers in the area as well, the largest of which is the Sofia River, whose drainage basin measures 27,300 km².

The region between Antsohihy and Maromandia boasts three environmentally-sensitive zones:

- the Bora forest reserve (special reserve category),
- the Loza mangrove (exceptional biological importance category: marshlands with major ornithological importance),
- dense dry forest of Andolokova (priority site for research on plants).

According to the WWF impact assessment one notes the presence of Periophthalmus Koelreuteri on the Maromandia-Ambanja section, which is an intermediary species between fish and amphibians, endemic to Madagascar. It lives in mangroves and breathes in the open air. The destruction of its natural habit would be a direct threat to the survival of the species.

The company also has a contractual obligation to respond to environmental regulations determined by the project manager and the Malagasy government, as stipulated in particular in the following:

- Law no. 97 017 dated July 16 1997 on forestry law,
- Law no. 98 029 dated December 19 1998 : Law on water,
- Law no. 99 021 dated August 19 1999, about industrial pollution management and control policies,
- Decree no. 99 954 dated December 15 1999, on mandatory environmental assessments (Mise En Compatibilité des Investissements avec l'Environnement - MECIE),
- Decree no. 2000-383 dated June 7 2000 on replanting forests,
- Inter-ministerial decisions no. 4305/97 dated March 15 1997 and no. 4355/97 dated May 13 1997, with the definition and delimitation of sensitive areas,
- Circulaire no. 911-46 dated June 13 1991 on the limitation of nuisance caused by works in cities, towns and villages.

An HSE cell was created to monitor these actions. With one expatriate French engineer, 2 Malagasy engineers, 3 doctors, 3 nurses and 3 technicians, it has been designed to prepare for and enforce the series of protective measures regarding environment, hygiene, health and safety.

2. ENVIRONMENTAL IMPACTS

2.1. The fight against deforestation

Deforestation is a major challenge in Madagascar. The rapid destruction of forest zones has led to catastrophic erosion, and the disappearance of exceptional fauna and flora that are unique in the world. Deforestation is also making the Malagasy people even poorer. It is due to two major causes: the manufacture of charcoal and farming techniques using fire clearing (which also has impact in terms of greenhouse gas emission and global warming). To help fight these phenomena, several actions have been implemented on the project.

2.1.1. *"Portable stove" policy*

Figure 1 - Fatapera Gas

To preserve the environment and limit deforestation due to an over consumption of charcoal and wood used for heating, the company rolled out a "portable stove" program on the project to favor the use of individual portable gas stove as an energy substitute.

The implementation of this program was the result of an obligation in the project's contract.

As such, the site personnel that comply with certain criteria were provided with a portable stove and a cartridge of gas.

Posters on sites and in base camps and villages were used to inform the workers about why the stoves should be used and how the program worked. Those who where given a portable stove were trained in its use before it was handed over to them.

2.1.2. *Managing land and vegetation*

Operations involving the clearing of brush and trees as required by the project are closely monitored, in particular during the clearing of the land take (roads, tracks, installations). To better preserve the flora in the regions that the road crosses, the following measures were implemented:

- limiting clearing to areas where it is strictly necessary for the project, defined with control body,
- limiting cutting of trees to those located in the land take and that would be a hindrance to the project, approved by the control body,
- ban on lighting fires along the roadside to prevent the risk of wildfire.

After they have been cut down, certain trees are handed over to the private owners or the administration to whom they belong, and others are given to the villagers for firewood (thus limiting the number of additional trees cut down).

In addition, in the framework of the project, nearly 16,000 trees of different types are being planted:

- fruit trees: avocados, lemons, jambuls, etc.
- ornamental trees: Caesalpinia pulcherrima, palm trees, mentali, … ;
- alignment trees: eucalyptus, bamboo, jatropha, …

When trees are cut down to widen roads, the operation is strictly controlled.

Awareness-raising programs have enabled the company's personnel and the neighboring residents to be informed of the issues involved.

Working closely with NGOs, the project's HSE team went on local radio to discuss the topic.

Colas' main partners are the Direction interrégionale des Eaux et Forêts (inter-regional water and forest division) and the inhabitants of reforestation zones. Involving local populations is important for several reasons: on the one hand, they offer substantial help in the program, and on the other, they are the first to reap the benefits of reforestation, as it helps protect farm lands and crops.

Base camps, offices, industrial sites along with a number of site machines have been equipped with fire-fighting equipment (extinguishers, etc.).

2.2. Preserving resources

The high degree of biodiversity and endemism of its flora and fauna make Madagascar one of the world's leading attractions in terms of preserving natural resources. Almost all the island's groups of fauna and flora offer unparralleled endemism; if one compares the number of species observed on the island to its surface area, Madagascar is without a doubt a land of mega-diversity. Madagascar's environmental equilibrium is however very fragile. Preserving the environment is one of the project's main priorities.

2.2.1. *Managing waste*

Wastes are evacuated to management and disposal centers that have been approved for each type of waste:

- Non-hazardous waste (banal industrial and household waste or Déchets Industriels Banals, according to French terminology) is collected in dedicated trash cans and receptacles. They are disposed of in a dedicated landfill that will be covered at the end of the project.
- Hazardous waste (special industrial waste (oils, etc.) or Déchets Industriels Spéciaux, according to French terminology) is mainly produced during the maintenance and operation of site machines and asphalt plants. This waste is collected in watertight drums and stored on dedicated sites until it is retreated (reused or recycled).
  An agreement was signed with Total to recycle oil and lubricants that are recuperated after an oil change, and thanks to which Total agrees to collect all used oil and lubricants for the entire RN6 project. The oil is treated and reused in "Eco-fuel" by mixing it with heavy fuel. Eco-fuel is used for cement plant furnaces. The program has been rolled out for the whole of Colas Madagascar.
- Liquid effluents: the sanitary blocks, latrines and sinks on fixed installation are hooked up to septic tanks. Waste water from the tank flows off to a cesspool where it is filtered by materials before infiltration.

2.2.2. *Re-landscaping*

The use of cut, pits and quarries can have a series of negative impacts:

- visual impact: the working face can destroy a landscape;
- impact on flora: work may damage existing plants and leave behind ground in which new plants may not grow back;

- structural impact: excavation may make ground unstable, which could lead to landslides;
- impact of crushing plants: dust from the crushing of aggregates is a nuisance for workers and neighboring residents.

Our solutions are as follows:

- visual impact: the working faces are, when possible, oriented so as to remain invisible from the road. If this is not possible, the site is re-landscaped at the end of the work to reduce the impact;
- impact on flora: topsoil is stored and put back in place when the work is over, which means that plants can grow back much quicker;
- structural impact: the sites are selected if possible with little or no slope. If there could be potential sliding, drains and reinforcements are used;
- impact of crushing plant: the impact of dust is reduced by the fact that quarries are located far from villages and that workers wear dust masks. Dust is also controlled by an automatic sprinkler system that is used on aggregates at several points and by the covering of the conveyor belts.

Figure 2 – Borrow pit

Figure 3 – Re-landscaped

In order not to perturb the natural habitat as much as possible, the worksite installations are demolished when they are no longer needed.

Once the borrow pit is no longer needed, it is re-landscaped using the topsoil that was stored near the site when the pit was opened. The surface is leveled to allow for proper drainage of rainwater runs, for plants to grow on the slopes and for new plants to be brought in if required.

2.2.3. *The fight against pollution*

- All liquid polluting agents are stored in retention tanks built in compliance with European standards to prevent any accidental pollution.

- Washing zones are equipped with hydrocarbon separators.

3. HUMAN IMPACTS

The construction work coupled with the arrival of new workers could have major socio-economic impact on the region that the roadway crosses. In order to reduce this negative

impact as much as possible, a certain number of measures have been taken for the duration of the project.

3.1. Building base camps

The company's personnel come from every region on the island, and in particular the highlands. The wide variety of locations of road construction projects means that Colas has to ask its workers to move around the entire country, which could create problems if nothing concrete is done regarding the following:

- separation of families,
- financial problems due to the management of two households,
- feeling lost due to new surrounding and integration in new social framework
- problems regarding a change in cultures, customs, and languages (dialects).

The company is aware of what is at stake and cares about the well-being of its people, so it set up a series of programs to accompany people and facilitate their social integration.

Figure 4 – Worker's house

Figure 5 – Base camp for workers

Roughly 2,000 people are needed to carry out the works. People are hired, when possible, directly in the region where the work is taking place. However, given the size of the project and the requirement for specially qualified personnel, the company had to hire part of its personnel outside of the work zone and train 400 machine operators.

In the end, the personnel is recruited 50% locally and 50% outside the region. To house all of the away-from-home personnel near the project, three worker villages were built next to the company's main base camps. These villages are equipped with a sufficient number of latrines and septic tanks and drinking water tanks so as to guarantee employees a level of hygiene that is compliant with legislation.

In addition, three medical centers – each run by their own doctor and nurse - were built near the three worker base camps.

3.2. Raising awareness about sexually-transmitted diseases and malaria

In partnership with PSI (Population Service International), the medical service and chief medical officer of the company presented a number of awareness-raising sessions on the prevention of serious diseases such as sexually-transmitted infections, malaria and diarrhea.

The project has brought in a great number of people, which could be an aggravating factor in the spread of HIV. The medical centers have been provided with free condom

distributors. Anonymous testing was made available one year after the launching of the site. 50% of the workforce has participated in this program and up to now, no one has been tested HIV positive. These results have encouraged the company to pursue its effort.

To limit the number of cases of malaria as much as possible, the company takes great care to avoid creating stagnant water sources near base camps or local villages whenever possible. In addition, mosquito nets were provided for personnel in the villages.

Figure 5 – Medical center

Figure 6 – Purifying water

Information conferences and awareness-raising sessions on health and hygiene are given four times a year by Doctor Isabelle Rakotoarisoa for the worksite personnel, their families and the neighboring residents.

The workers' drinking water is systematically treated in water purifiers.

3.3. Safety of personnel

All site personnel have been provided with the appropriate personal protective equipment, in line with the specific requirements of each job: protection of the body, feet, head, hands, eyes.

An extremely strict safety policy has been implemented on the RN6 project, the goal being to prevent accidents for both workers at Colas and for road users and local populations.

The personnel have regular awareness-raising sessions via toolbox talks and posters in each workshop, designed to highlight good practice in accident prevention.

Audits are undertaken on a regular basis to anticipate any possible divergence from the policy.

4. ASSESSMENT AND CONCLUSION

Thanks to the rehabilitation of National Route 6, the Sofia region is opening up. Up to now, local production was exploited on a very small scale. Today, the region can now play an active part in the country's economic development.

The regions crossed by the roads that link Port-Bergé and Ambanja will now again be in a position to enjoy a large-scale economic boost, based on the once-thriving cotton, peanut, cacao, tobacco, spice, and ylang-ylang industries, along with the exploitation of chromite, fishing, etc. RN 6 was untraffickable nearly 6 months of the year, which meant that production had dropped considerably.

Conditions for development in the region will soon be met.

Opening up Sofia region will also build a link between the northern point of Madagascar, in particular Anstiranana (Diego-Suarez) and the rest of the country. This region has great economic potential and can develop currently unexplored sectors such as tourism, with environmental sites in the bays along the Mozambique canal, archeological and historical sites and natural reserves.

The region may also host, as is the case in the rest of the Island, scientific research teams working on the various endemic plant and animal species.

From an environmental and socio-economic viewpoint, the positive impacts of the rehabilitation of RN6 will appear progressively over time. Concrete results will be observed in the long-term. In fact, even if economic expansion in a region does not occur overnight, the existence of a road network that can ensure the transport of goods and people does guarantee rapid, sustainable development in a region, and in the country as a whole.

Reference

1. Environmental impact assessment. Construction and rehabilitation of RN 6 between Port-Berger and Ambanja. Report July 2002