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H.J. Ruitenbeek Resource Consulting Limited

Environmental and Development Economics

Attention: Jack Ruitenbeek
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This is a utility site to download documents related to the Mandelbrot Development Project Case Study.

The Mandelbrot Project: A Case Study in Applied Decision-Making in Environmental Economics. Ruitenbeek J. 2000 [November]. Prepared for IDRC/EEPSEA (Economy and Environment Program for South East Asia), Singapore (<http://www.eepsea.org/>)

Introduction

The Mandelbrot Development Project is a hypothetical development project in a developing country. The project design is based on typical circumstances in a hypothetical low-middle income country (Mañanaland), and draws on actual conditions from a cross-section of real-life projects in Sub-Saharan Africa, the Indian Ocean island states, the Indian sub-continent, Southeast Asia, and the Caribbean. The case study site features a coastal region (Deli Province) with typical bio-geographic and socio-economic conditions of high poverty levels, environmental degradation from deforestation and marginal agriculture, and an artisanal fishery industry. The area also features a recently established terrestrial biosphere reserve (Deli National Park) of international importance, and ecotourism around a marine park area (Deli Archipelago) is slowly being developed close to the sea-side provincial capital of Fort Brot. The Mandelbrot Project is composed of a number of regional development activities that include: (i) a mining project to extract ilmenite; (ii) a port expansion component required for the mining development; and, (iii) associated infrastructure.

The case study exercise provides a role-playing context ("game") for students of environmental economics. The purpose of the exercise is not so much to have students undertake an environmental economics study, as it is for students to gain an understanding of the decision-making and policy formulation dynamics that often surround such studies.

Students are divided into groups of 10-15 people, with each person representing a "player" in the game. The players are invited to a half-day meeting to consider the development options for the province, and to determine whether the Mandelbrot project should (i) proceed immediately; (ii) proceed in some modified form; (iii) be abandoned; or (iv) be deferred until further research is done. The Project itself will be funded through the following formula: 25% private sector; 25% government contribution; 50% international assistance. All players in the game are given the same background information, which consists of an invitation to participate, a list of participants, and an economic consultant's report. The meeting is chaired by a representative of Central Government who, in tandem with a representative from an international development agency, is tasked with garnering input from various stakeholders in the province.

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Mandelbrot Project

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[CLICK HERE FOR PREVIOUS PAGE \("Introduction"\)](#)

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The Mandelbrot Project: A Case Study in Applied Decision-Making in Environmental Economics. Ruitenbeek J. 2000 [November]. Prepared for IDRC/EEPSEA (Economy and Environment Program for South East Asia), Singapore (www.eepsea.org)

The material in this package is background material prepared for EEPSEA by Jack Ruitenbeek. Ownership of this material resides with the International Development Research Centre through its representative EEPSEA (<http://www.eepsea.org>).

In this package you will find the following:

1. A convenor's package (uneditable) in *.PDF format [[Click to download Mandel.pdf](#)]. This requires Adobe Acrobat Reader to read, available at www.adobe.com as a free download for any platform.
2. The same document as an MS Word document [in two parts: [Click to download Mandel01.DOC](#) and [Mandel02.DOC](#)]. This is editable should you wish to modify the material for your own purposes. Please contact EEPSEA (<http://www.eepsea.org>) to obtain permission to use this material in a commercial training context.
3. A sample spreadsheet in Excel format [[Click to download Mandel.XLS](#)]. Only selected cells of the spreadsheet are editable to show the impacts of selected scenarios. This prevents inadvertent changing of the formulae. Please note that this is a 'minimalist' analytical spreadsheet. It shows cash flows for single investment and operating revenues and factors all other NPV from these as it is assumed that no differential cost/revenue escalation occurs. If at any time you are prompted for a password to access the spreadsheet, type in the following (lower case letters):

eepsea

4. The additional file in this package also provides a potential "improved" Option [[Click to download Mandel_Best.XLS](#)] that

picks and chooses parts of the Options A and B. Essentially, the improved Option includes Option A plus partial investment in a road and full investment in a filled-in wetland. The fish landing site is not moved and resource exports go via rail to the dedicated "Option A" port. This is one potential "improved Option" that may emerge from the role playing exercise. Information regarding this option should **not** be given to anybody prior to the exercise.

For clarification, we also note here for the record that the consultant report contains the following deliberate typographical errors relating to operating costs:

1. The table showing cash flow summaries places the "operating and maintenance" costs of \$3.5 million in the wrong column. The \$3.5 million/yr entry belongs under Option B but not under Option A. The text that refers to this reads correctly, showing Option A operating costs to be lower than Option B operating costs. This transposition is a typographical error and does not affect the final results or calculations.
2. The text that refers to that same table states that reclamation expenses are \$4 million/yr whereas the table shows \$5 million/yr. The correct figure is \$5 million/yr and all calculations in the report are consistent with the \$5 million/yr operating expense.

The convenor may treat this information in a number of different ways, depending on the specific intent of the exercise.

1. Not inform anybody of this.
 2. Inform only "Dr Econo", who may then volunteer the information or provide it should the issue arise.
 3. Advise all participants.
- End.

Jack Ruitenbeek

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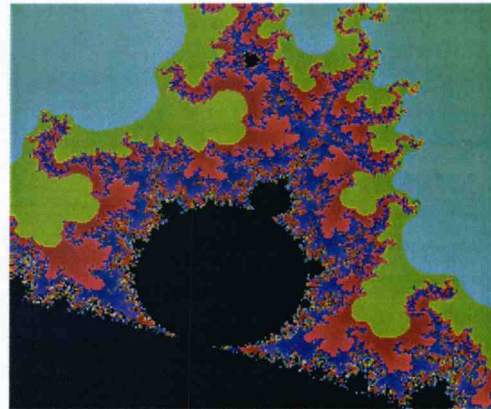
Mandelbrot Project

Convenor's Package

(for case study convenor only)

The Mandelbrot Project: A Case Study in Applied Decision-Making in Environmental Economics

Prepared by Jack Ruitenbeek*, for the Economy and Environment Program for South East Asia (EEPSEA), Singapore.



Introduction for Case Study Convenor

The Mandelbrot Development Project is a hypothetical development project in a developing country. The project design is based on typical circumstances in a hypothetical low-middle income country (Mañanaland), and draws on actual conditions from a cross-section of real-life projects in Sub-Saharan Africa, the Indian Ocean island states, the Indian sub-continent, Southeast Asia, and the Caribbean. The case study site features a coastal region (Deli Province) with typical bio-geographic and socio-economic conditions of high poverty levels, environmental degradation from deforestation and marginal agriculture, and an artisanal fishery industry. The area also features a recently established terrestrial biosphere reserve (Deli National Park) of international importance, and ecotourism around a marine park area (Deli Archipelago) is slowly being developed close to the sea-side provincial capital of Fort Brot. The Mandelbrot Project is composed of a number of regional development activities that include: (i) a mining project to extract ilmenite; (ii) a port expansion component required for the mining development; and, (iii) associated infrastructure.

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Students are divided into groups of 10-15 people, with each person representing a “player” in the game. The players are invited to a half-day meeting to consider the development options for the province, and to determine whether the Mandelbrot project should (i) proceed immediately; (ii) proceed in some modified form; (iii) be abandoned; or (iv) be deferred until further research is done. The Project itself will be funded through the following formula: 25% private sector; 25% government contribution; 50% international assistance. All players in the game are given the same background information, which consists of an invitation to participate, a list of participants, and an economic consultant’s report. The meeting is chaired by a representative of Central Government who, in tandem with a representative from an international development agency, is tasked with garnering input from various stakeholders in the province.

* The author may be reached at: HJ Ruitenbeek Resource Consulting Limited, RR2 - Site 52 - C21, Gabriola BC, Canada V0R1X0 Tel +1 250 2478436 Fax +1 250 2478492 <hjr@island.net> URL: <http://www.island.net/~hjr>

Goals of the Exercise

The pedagogical goals of the exercise are as follows:

- a) demonstrate that the same economic analysis can be used in different ways by different players. The policy implications of a given study are likely dependent on the positions and interests of respective stakeholders.
- b) demonstrate that CBA is just one of potentially many criteria that can be considered in a decision-making context.
- c) demonstrate that even a relatively thorough CBA and associated set of economic studies will often give imperfect and incomplete information for decision-making, and that decision-making will depend on different power relationships and other information.
- d) provide an opening point for discussing multi-criteria decision-making (MCDM) as a tool in policy formulation.

This is entitled the “Mandelbrot Project” to underline also the role of complex systems in such an exercise. Mandelbrot is largely credited with moving forward the science of complexity, and the links between order and chaos are receiving greater attention in all realms of analysis. The Mandelbrot set image (on the cover of this document) also demonstrates the infinite interleaving layers of order and chaos that come about from a simple mathematical expression.

Features of the Scenario

The following are key features of the development scenario:

- Mine development will be on a 7000 hectare area to collect and refine ilmenite, which is a heavy black mineral that mixes with surface soils and sand and is used in such items as paint, toothpaste, sunscreen, knee joints, and candy. It is mined using a “floating barge” technique that strips away the surface layers and redeposits spoils at or close to the mine location. The concession area is currently being deforested by unregulated fuelwood gathering. The mine operation will take down the existing forest, and will reforest it with sustainable woodlots during reclamation. The mine site development will include a refinery and a power plant. The power plant will generate surplus power that will flow back into the local grid.
- The export of the ilmenite requires expanding the existing port in Fort Brot (40 kilometers away) to accommodate the higher volumes. Port expansion will require that a fishing landing site be moved and that a wetland be filled in. The resulting port expansion and associated road infrastructure will improve marketing prospects for what is currently a marginal agricultural sector in the province. It will also improve tourism access to the National Park (the new road from Fort Brot to the mine site will cut through one section of the Park.)
- A major concern is the impacts of the development on the Deli Archipelago, which is a national asset for its small islands and associated reefs. It is receiving world wide attention as prime tourist development site and, although the port does not directly impact it, the archipelago lies directly in the path of all marine traffic using this port.

General Package

A “General Package” that is distributed to all participants contains the following:

- a) introductory note. This is a covering note stating that the materials for the plenary exercise are enclosed.
- b) invitation. This is a generic form letter from the Minister of Economic Planning to the various players, inviting them to participate in the exercise. It outlines the goals of the meeting and the decision options.
- c) participant list and general profiles. This is a list of the participants in the exercise. It includes 10 mandatory functional roles and some extra “optional” players. The number of players may be as high as 20 because some of the given “roles” may potentially be represented by a “delegation” of more than one individual. For each participant a brief “profile” is presented so that all of the players have a common understanding of the roles represented.
- d) addendum letter. This is from one of the participants who is advocating establishment of a free trade zone in this area.
- e) consultant report. This is a “Management Summary” report that includes a description of the site, and the project options. It provides environmental economic analyses of certain values at risk, as well as economic costs of various development options. It also provides limited results of employment impacts and of potential GDP impacts. It uses conventional CBA protocols and presents a distribution of costs and benefits according to various productivity centres. The report also comments generally on risks and uncertainties, and lists some “unquantifiable” costs. The base case of the report shows that the full Mandelbrot Project is economically justifiable. Enough information is also provided, however, that one might argue on economic grounds for any of the potential development alternatives through (for example), changing the shadow price of labour, choosing a precautionary approach, or choosing welfare weights in an MCDM framework. The consultant’s report states that it was cost-shared over a one-year study period with contributions from the Government, foreign donor agencies, and the mining company itself.

Individual Package

In addition to the common material described above, each individual player will receive a one-page “profile sheet” that gives them some further information about their role. In some cases it also provides some vague “hints” or “tips” (that only they will see), that may be helpful to them in promoting their own positions.

Conduct

The distribution of the material and the conduct of the exercise should reflect the following:

- materials should be circulated a day or two before the actual meeting. Participants should have well-defined pre-assigned roles, with latecomers joining as delegations or ‘optional’ players. Participants should be encouraged to discuss their roles and form alliances before the meeting.
- meeting conduct should permit the chair to convene the meeting and run it as he/she sees fit. The rapporteur of the meeting is, in fact, a representative from the international donor community. A suggested agenda for convening the meeting will be as follows:

- individual presentations. Each person will be invited to make a 3-5 minute presentation stating their preferred option and referring to the study results.
 - general discussion. To be facilitated by the chair.
 - general resolutions. The goal of the meeting is to provide a clear recommendation to the Central Government and to the international donor community.
- if there is more than one concurrent case study being conducted, all participants can convene for a brief plenary session to share conclusions and observations.

Other

The following page provides a worksheet to assist the convenor in assigning the roles to individual participants. Upon completion, it may also be distributed to all participants or posted in a conspicuous place such that individuals can have an opportunity to interact before the meeting.

Mandelbrot Project Meeting

Group: _____ (if more than one group)

Date: _____

Time: _____

Place: _____

Role	Participant(s) Assigned
Chair - Deputy Minister of Economic Planning	
Rapporteur - Chief Economist for the Global Development Bank	
Consultant - Dr Econo, President of Anthropophobic Consulting Group	
Governor of Deli/Mayor of Fort Brot	
President, Chamber of Commerce	
President Hotel and Tourist Association	
Head of Fishery Co-operative	
Local Representative of World Environment Union	
Chief of New Deli Village	
Officer from Ministry of Forests, Agriculture and Fisheries	
Mining Company (MinComp) Representative	
Deputy Minister of Transportation, Communications and Utilities	
MegaCorp Trading Representative	

November 2000

Mandelbrot Project

General Package

(for distribution to all participants)

Dear EEPSEA Participant,

RE: Case Study - Mandelbrot Project

As a change of pace, a case study has been prepared by Jack Ruitenbeek that involves a role-playing session. During this session, each person will take on a different “role” during a decision meeting on a hypothetical development project - The Mandelbrot Project. In this package you will find an invitation to participate, a background consultant’s report, and other material you may find useful in preparing for the meeting.

The Mandelbrot Development Project is a hypothetical development project in a developing country. The project design is based on typical circumstances in a hypothetical low-middle income country (Mañanaland), and draws on actual conditions from a cross-section of real-life projects in Sub-Saharan Africa, the Indian Ocean island states, the Indian sub-continent, Southeast Asia, and the Caribbean. The case study site features a coastal region (Deli Province) with typical bio-geographic and socio-economic conditions of high poverty levels, environmental degradation from deforestation and marginal agriculture, and an artisanal fishery industry. The area also features a recently established terrestrial biosphere reserve (Deli National Park) of international importance, and ecotourism around a marine park area (Deli Archipelago) is slowly being developed close to the sea-side provincial capital of Fort Brot. The Mandelbrot Project is composed of a number of regional development activities that include: (i) a mining project to extract ilmenite; (ii) a port expansion component required for the mining development; and, (iii) associated infrastructure. The following are key features of the development scenario:

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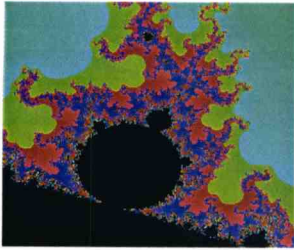
The purpose of the exercise is not to undertake an environmental economics study, but to use an existing study within the context of a typical decision-making framework. It is hoped that you will gain some insights into how such studies can be used by different people, as well as appreciation for some of the policy formulation dynamics that often surround such studies.

In your package you will also find an “individual profile” that gives you a bit more background on your individual role. It also provides some hints and tips that you may want to consider as you prepare for the meeting. (Others will have received different tips so guard your own closely!)

Please note also that, at the beginning of the meeting, everybody will be invited to make a short statement or presentation regarding their position.

Have fun!

November 2000



From the desk of:

Mandelbrot Project Office, Ministry of Economic Planning

Box 3120

Mangoville, Mañanaland

06 November 2000

Dear colleague,

RE: Roundtable Review and Decision Meeting - 22 November 2000
Mandelbrot Project, Deli Province

You are hereby invited to the above meeting to discuss the captioned Project.

As you are no doubt aware, the Mandelbrot Project Office was established in 1997 to conduct a series of work programs associated with investigating the feasibility of pursuing that Project. At that time, MinComp Ltd. was given conditional approval to proceed with the project subject to their securing financing and conducting associated environmental impact and socio-economic assessments through a public process. The environmental impact statement was completed in mid-1999 and has been reviewed internally by the Project Office and has been found to be in compliance with national requirements; it describes the mitigative measures that would be undertaken as part of the project for environmental controls.

At that time, MinComp also secured funding for its equity contribution to the Project, and indicated that it would need a "go" or "no-go" decision from the Government by 30 June 2000. That date has subsequently been extended to 31 December 2000 to permit completion of some economic studies, and we are informed that this final deadline is now no longer extendable.

Over the past year, an economic study was thus made of the socio-economic impacts of the project, as well as some project alternatives. The Management Summary of the study is enclosed.

The purpose of the meeting is to discuss the findings and recommendations of the economic study, and to decide on the next steps in the Project Approval Process. Based on input received at this meeting, the Government will decide whether to: (a) approve the Project as defined; (b) propose a modified Project; or (c) abandon the Project.

The agenda for the meeting will permit each individual participant up to 5 minutes at the outset to put forward their position or to comment on parts of the Consultant's report that are relevant to them. Following that, there will be a general discussion. The final goal of the meeting is to provide a clear recommendation to the Central Government and to the international donor community.

As I will be unable to attend that day, our servant the Deputy Minister of Economic Planning will chair the meeting in my place. Also in attendance will be the Chief Economist of the Global Development Bank, which is coordinating the foreign donor effort that will potentially contribute 50% of the financing to the project.

Hail Mañanaland!

General IMA Mangosaur

Participant Profiles

Chair - Deputy Minister of Economic Planning. This person is tasked with chairing the meeting and is also representing the views of the central government. The central government will be guarantying 25% of the financing for this project. The government is formed after an election once every five years and is currently in year 2 of its term. Note that this Ministry, through the Mandelbrot Project Office, was also responsible for the review and approval of the Environmental Impact Assessment completed some time ago.

Rapporteur - Chief Economist for the Global Development Bank (GDB), an international consortium of donors that will be donating through direct grant or soft loans up to 50% of the financing for the project. The Chief Economist is responsible for projects in Mañanaland plus 8 other countries in the region. His/her recommendation and observations at this meeting will likely play a pivotal role in whether the project moves forward. The chief economist must be satisfied that the project meets certain criteria of economic acceptability while also conforming to social and environmental policies and guidelines that govern the GDB.

Consultant - Dr Econo, President of Anthropophobic Consulting Group: the firm that wrote the economic analysis report. He/she did not, however, have any hands-on experience with the report, which was prepared by two of the firm's senior staff. Dr Econo knows all about economic analysis, but is not necessarily that familiar with the actual study results. Nonetheless, he/she will defend the results and will try to answer general questions if asked.

Governor of Deli/Mayor of Fort Brot. This is the most senior position in the Province, and is an appointee of the Central Government through the Ministry of Local Government. Local government has recently received constitutional powers of indirect taxation and revenue collection, while also being responsible for monitoring and enforcing land use planning and environmental compliance.

President, Chamber of Commerce. This is an industry representative. The local chamber of commerce includes all private sector commercial and industrial players, including agricultural processing firms, sawmill operators, and other industrial (non-mining) operations.

President Hotel and Tourist Association. This is a representative for the local hospitality industry. The association membership currently includes 10 hotels/motels, 43 restaurants, the national airline, 3 private tour operators, 2 sport fishing boat charter operators, a scuba dive shop, and an operator of a semi-submersible submarine that takes tourists out to see the coral reefs in the Deli Archipelago.

Head of Fishery Co-operative. The fishery co-operative has been established for 15 years through domestic and foreign assistance. A marketing co-operative has promoted artisanal demersal fishing, and recent construction of a cold storage unit in Fort Brot has reduced spoilage significantly. Fish has become an important and affordable staple protein in the diet of many people in the Province. Although fishing remains a small part of total GDP (<2%) it creates significant seasonal employment for young men who would otherwise have no work. Establishment of the Port will require deepening the harbour and will increase the threat of pollution in critical fishing grounds; the fishery landing site and associated cold storage units will need to be moved to a new fishery landing site to be constructed just outside of Fort Brot, close to (but not on) some of the prime tourist beaches. Construction of the landing site will involve filling in a wetland that is now a breeding ground for anopheles mosquitoes (carrier of malaria).

Local Representative of World Environment Union. The WEU is an Environmental NGO that has been active in the region for 20 years. Its efforts, funded through international donations and local volunteerism, were largely responsible for the establishment of the Deli National Park (inland) and the local marine park in the Deli Archipelago. It promotes sustainable development of local resources. The WEU currently operates the marine park in the Deli Archipelago, until such time as a more permanent management authority is established. WEU is also implementing the Deli National Park development project that will see greater tourism access to the inland park areas.

Chief of New Deli Village. This village and its surrounding area has 3000 inhabitants and was previously called simply Deli Village and was next to what is now the National Park. Upon establishment of the Park, Deli and its inhabitants were resettled 50 kilometers east and were provided with fresh farming land, homes, a school, and a medical clinic. The villagers rely, as do other villages in the region, on the forested area of the proposed mining concession for their fuel wood and other NTFPs. One year after their resettlement, exploration and development was commenced on the proposed mining area. A young child was recently killed in the village when playing with explosives found near an abandoned exploratory test hole. Young women in the village have been caught up in small-scale prostitution, and the incidence of sexually transmitted diseases is on the rise. Recent clashes have occurred between mine workers (who are semi-skilled labourers involved in exploration efforts, but are not from the area) and local villagers (who are trying to fish in local streams). These factors have given rise to a local movement opposing the mining project.

Officer from Ministry of Forests, Agriculture and Fisheries. This person is responsible for all regulations pertaining to agricultural land use, forestry and fisheries in Deli province. The local government office in this case consists of 3 people: this officer, a secretary, and a driver. The office currently has adequate funding for salaries, and for the operation and maintenance of some equipment; but for little else.

Mining Company (MinComp) Representative*. This person is in fact a lawyer and knows very little about the specific mining operations or plans at this site. He/she is here as an observer and is prepared to speak to any past incidents that may have occurred at the mine site. The representative will consistently restate their commitment to meeting local and international standards for safety and environmental issues. The person is not empowered with any ability to make commitments on behalf of the company.

Deputy Minister of Transportation, Communications and Utilities*. This person will be in charge of overseeing the public infrastructure development (roads and power) associated with the Mandelbrot Project.

MegaCorp Trading Representative*. This person represents a company that is a joint-venture partner with MinComp in other countries. MegaCorp advocates the establishment of free trade zones (FTZ) and this individual supports as large a development scheme as possible locally. MegaCorp has written a brief letter (attached) stating that it would under-write one half of the Government financial commitment for the Mandelbrot project if it were in turn permitted to develop an exclusive free trade zone in association with the new port facilities at Fort Brot. The FTZ would include a commercial and industrial value added zone that was tax exempt.

*Invited but attendance is not mandatory.

November 2000

MegaCorp Inc.

"Free Trade for World Peace"

Freeport, Union Islands 45612

04 November 2000

Minister IMA Mangosaur

Mandelbrot Planning Office, Ministry of Economic Planning

Box 3120

Mangoville, Mañanaland

Dear Minister,

Please be advised that we have reviewed the project documents and various proposals associated with the Mandelbrot Project.

We believe that the proposed port expansion facilities at Fort Brot will create significant economic benefits for your nation. We also believe that this expansion just opens the door to even greater employment opportunities. We have conducted extensive analyses of trade profiles within the geographic region and we believe that Fort Brot would be an ideal candidate for a free trade zone (FTZ).

We are therefore prepared to commit up to one-half of the government's share of the funding to this project in exchange for the following:

- establishment of a free trade zone within 5 km of the Fort Brot Port facility. The zone may include industrial or commercial activities, including value-added processing of imported items.
- activities within the zone will enjoy duty-free import of goods, as well as tax exempt export. No income taxes will be payable on that part of a firm's profits that derives from activities within the FTZ.
- firms within the FTZ will pay user fees (on a cost recovery basis) for services that are provided by the government or nearby municipalities (e.g., water, communications, power, sewage treatment).

We understand that you will be having a decision-meeting regarding this project shortly and hope that you will look favourably on our offer. If requested, a representative from our firm can be available for that meeting.

Yours sincerely,

Trader Vic, President

November 2000

The Mandelbrot Project, Mañanaland

An Economic Analysis

Prepared by the Anthropophobic Consulting Group

for

Mandelbrot Project Office
Ministry of Economic Planning
Mangoville, Mañanaland

November 2000

(Final Report – Management Summary)

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Study Background and Process

This study was conducted at the request of the Government of Mañanaland (GOM), over a one year period commencing in October 1999. Study funding was provided through a cost-sharing arrangement among the GOM, the international donor community, and the project proponent – MinComp Ltd. In 1999 an Environmental Impact Assessment (EIA) determined that the project could meet or exceed all national environmental guidelines. Subsequent to completion of the EIA, this study was undertaken to determine the overall economic desirability of the project.

The study's terms of reference required that it rely on conventional cost benefit analysis procedures to compare the major project alternatives put forward by the project proponent. In addition, the study used standard methods of environmental economic analysis to quantify a number of the environmental costs and benefits associated with the project. In undertaking this approach, the study relied on the following sources of information:

- direct project cost information was taken as provided by the proponent.
- associated infrastructure costs are consistent with infrastructure costs within Mañanaland, as reflected in the GOM 5 Year Budget last reviewed in 1998.
- estimates related to various unmarketed goods and services were based on household surveys undertaken in Deli Province, and on selected tourist surveys conducted over the past year.

In addition, the study relied on extensive consultations with local user groups to help determine relevant pricing and related assumptions for traded goods such as fishery products, future potential value added processing from agricultural commodities.

Description of Study Site and Project Area

The Mandelbrot Development Project is in the southern province of Deli. Some key economic indicators are presented in Table 1. The capital – Fort Brot – was historically an important colonial fortification that subsequently saw prominence as an export point for tropical hardwoods that covered most of the province. Over a period of some 50 years, most of the province was deforested, and plantation agriculture was established in some of the low-lying areas. Through a quirk of history, the colonial Governor of the area at the time was a cat lover and had arranged to set aside a 300km² private reserve where a rare species of forest ocelot made its home. After the Insurrection of 1962, colonial rule was transferred to domestic rule centred in Mangoville, and the economic importance of Fort Brot and Deli Province waned. Through the 1960s and 1970s, population of the Province grew at an average rate of 10% annually, largely because of in-migration from political instability elsewhere in the country. The new settlers tended to congregate along the coastal areas and in small villages throughout the secondary forest areas of the province. These

Table 1
Selected Economic Statistics

	Deli Province	National
Population 1999	375,000	8,400,000
Households 1999	75,000	1,680,000
Urban Population	70,000	2,750,000
Urbanization Rate	18.7%	32.7%
GNP million US\$ (est)	225	7,140
GNP/capita (\$US/yr)	\$600	\$850
GDP - Agriculture (%)	n.e.	32
GDP - Industry (%)	n.e.	17
GDP - Services (%)	n.e.	51
(n.e. - no estimate)		

forests were eventually also reduced to scrub forest as they were replaced by small-scale marginal agriculture. While the population influx eventually abated, the area is still one of the least developed within the country.

Through the 1980s, it was realised that the natural beauty of the area was perhaps its greatest asset. With the assistance and efforts of local NGOs and international environmental interests, the Deli National Park was established to protect the habitat of the famed forest ocelot. Adventure tourism to this area grew rapidly, and Deli Province soon discovered that it had an internationally marketable combination of tourist assets all within a short distance of Fort Brot. The Deli Archipelago – a group of islands with associated coral reefs – has since been declared a World Heritage Site for its marine diversity. Tourists visiting the area can now avail themselves of visits to the National Park, boat trips to the islands for snorkelling or diving, or unlimited sunbathing along 15 kilometers of beach just to the north of Fort Brot. The major constraints to further development in this area are as follows:

- a) Fort Brot itself is unattractive to most tourists because of its derelict port and run down urban conditions. Most new development has occurred preferentially near the beaches, and the tourists tend to stay in those areas.
- b) road travel within the province – and to Deli Park in particular – remains slow and dangerous because of poor road conditions.
- c) malaria remains a problem in the coastal areas.

The province has thus been struggling in its attempts to extricate itself from this situation. Foreign assistance has been available, but it has been limited and in any event it has been distributed by the Central Government to all of the provinces on a relatively equal basis. In the case of Deli Province, the foreign assistance has been directed primarily into the following areas: (i) social sector improvements for upgrading local schools and medical clinics; (ii) a rural electrification project that now supplies 50% of the population with electricity; (iii) an infrastructure project that provided for limited road rehabilitation and safety equipment for the local airport at Fort Brot; and, (iv) a fishery enhancement project that provided cold storage facilities and a fishery landing site in the heart of Fort Brot harbour.

In early 1990, however, another potential opportunity arose. A geologist visiting the area as a tourist noticed that the white beach sand contained some interesting black flecks. She hired a local fisherman to take her further up the coast and discovered the greatest concentration of these flecks to be some 50 km north. Packing some of the sand home with her, she later analyzed the black flecks as ilmenite, which is a heavy black mineral that mixes with surface soils and sand and is used in such items as paint, toothpaste, sunscreen, artificial knee joints, and candy. She ended up selling this prospecting information to MinComp Ltd., which produces some 25% of the world supply of ilmenite; MinComp in 1991 secured mining concessions from GOM over some 150 km² of Deli Province. The concession lies in one of the last remaining secondary forests in Deli Province. Subsequent exploratory work confirmed rich deposits within this zone, and in 1997 the GOM had given MinComp conditional approval to proceed with project development, subject to a satisfactory EIA and secured funding arrangements.

A map of the area is shown in Figure 1.

Mandelbrot Development Project
 Option A: Railroad to New Dedicated Port
 Option B: Upgraded Road to Expanded Port at Ft. Brot

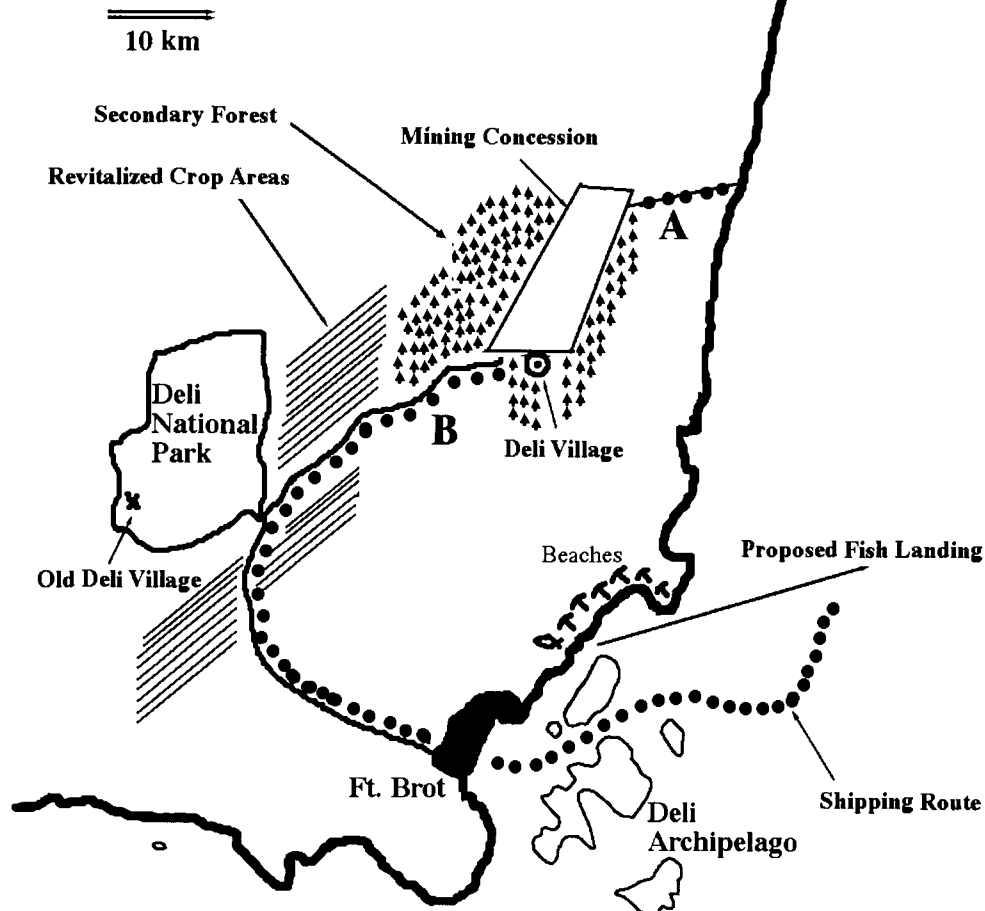


Figure 1.

General Description of Project Alternatives

The mine development plan for this project consists of a 25 year extraction project that involves the collection and separation of ilmenite using a "floating barge technique." Ilmenite occurs in the near surface deposits and soils, and the techniques used are thus those of surface mining. The total affected area over the project life will be 7000 ha within the mining concession, although at any single point in time the operation will cover only a 200 meter by 200 meter area that moves slowly across the project area from day to day. Ilmenite will be separated from the sand at a central separation plant and power plant. The power plant will generate surplus power that will flow back into the local grid. The project will remove the existing forest cover and reforest it in its path through a reclamation project that involves the replanting of eucalyptus. The technical viability of the reclamation component of the project

has been established through a forest rehabilitation project conducted by MinComp over the past 5 years.¹

Two general project options have been elaborated by the proponent. Both of these projects have similar mine development plans, but the associated infrastructure in each case is quite different.

Option A – Stand-Alone Project. Railroad and New Dedicated Port. In this scenario, the ilmenite is shipped to a tidewater site by a 10 km railway system built specifically for this project. The tidewater site would require construction of a small new dedicated port and breakwater for the export of the ilmenite. Under this scenario, the company will bear 75% of the costs of the project.

Option B – Integrated Project. Upgraded Road to Expanded Port at Fort Brot. In this scenario, ilmenite is shipped via an upgraded road to an expanded port facility at Fort Brot. The road upgrade would create a year round road capable of handling large volume industrial traffic. The port expansion would involve construction of a multi-purpose port that would handle the ilmenite freighters, as well as cargo handling facilities for other goods. The expanded port will also accommodate one cruise ship berth. Under this scenario, the company will bear 25% of the total project costs.

The associated impacts of these two scenarios differ considerably. In the case of the stand alone project (Option A), impacts of the project are largely contained to the mining concession site and adjacent area. In the integrated project, a number of associated impacts occur. Key direct additional benefits are: (i) improved access to Deli National Park; (ii) improved agricultural benefits from approximately 30,000 ha of marginal cropland. One additional element, however, requires that the fish landing site currently in Fort Brot harbour be moved. The proposed site is just north of Fort Brot, and construction of this landing site will involve infilling a wetland that is adjacent to some of the prime tourist beach areas. Another concern is that increased shipping traffic may pose a hazard to the Deli Archipelago.

The direction of mining also differs between the proposals because of the location of transportation infrastructure. In Option A, mining will commence in the north and proceed southward. In Option B, mining will commence in the south and proceed northward.

Project Revenue/Cost Sharing Assumptions

The project cost and revenue sharing arrangements between the government and MinComp are consistent with those in the Memorandum of Understanding of 1997. Under this MOU, the following terms are relevant to this analysis:

- MinComp will operate the project, incurring all operational costs (including reclamation).
- MinComp will finance 75% of project capital costs in the event a stand-alone project (Option A) proceeds; it will finance 25% of project capital costs in the event that an integrated project (Option B) proceeds.
- the Government of Mañanaland will receive a gross royalty on all ilmenite sales equal to 20% of the value received f.o.b. a tidewater site.

¹ Since 1995 the company has been spending some \$4 million a year on this project on a test area within the mining concession. The World Environment Union and the Ministry of Forests, Agriculture and Fisheries have been monitoring this project as described in the EIA. At time of writing, rehabilitation has been successful on 80% of the land after the first attempt and 95% after the second attempt.

- all surplus electricity generated by the power plant will be the property of the Government and will be delivered directly to the national power grid.

Analytical Assumptions

In conducting the cost benefit analyses (CBA), government direction was sought on the values of various parameters. Based on such consultations, the following assumptions were agreed to:

- discount rate. All public sector investments are compared at a real discount rate of 10%. This is therefore the base case taken for this analysis. We also, however, provide results at discount rates of 5% and 15%.
- donor resources. Donor resources are treated equivalently to other government (domestic) resources on the assumption that they are fungible and would need to be directed to the best available opportunities. Many of these will have payment terms attached and the government is exercising due prudence to ensure that cash flows can indeed meet any such repayment requirements.
- shadow wage rate (SWR). Because of the high level of unemployment in Deli, it was suggested that unskilled labour should be valued at 50% of the market rate for the purpose of social CBA. Because it was believed that these levels of unemployment are not likely to be permanent (and would likely drop in the long term in the event that the project proceeded), this SWR should be applied only during the investment period.
- welfare weights. It was requested that the project analysis treat all costs and benefits to Mañanaland equivalently. The only separation that should be reflected is that between MinComp and Mañanaland (i.e., MinComp equity investments and net profits are treated as external to this project).

In addition, it was agreed that the project would be evaluated over a 28 year time horizon corresponding to the anticipated 3 year investment period followed by a 25 year mine production life.

In using these assumptions, we also note that the following simplifying assumptions were made in the process:

- no premiums were assigned to foreign exchange earnings; and,
- no analysis was conducted of the reduction in local “unmet electricity demand” that would arise as a consequence of this project. The analysis took a national figure for the marginal cost of additional electricity supply as a basis for valuing the power generated by this project.

Both of these simplifying assumptions may cause a slight underestimate of project benefits.

Finally, we note that the baseline scenario of “no project” assumes that neither Option A nor Option B proceeds. By definition the net present value (NPV) of the baseline scenario is taken as zero, and all costs and benefits in the two options under consideration are taken as incremental to this baseline. The NPV of Options A and B can thus be compared directly as they are two mutually exclusive projects. The economically optimal project will thus be the one with the highest NPV (or, if both Options have negative NPVs, the optimal project would be the baseline scenario of “do nothing.”)

Table 2. Summary of Costs and Benefits from Project (US\$ 2000)		
	Option A	Option B
Project Revenue		
Ilmenite sales	\$25 million/yr	\$25 million/yr
Surplus power value	\$2.0 million/yr	\$2.0 million/yr
Capital Costs		
Construction capital costs	\$55 million includes \$50 million for mine capital and \$5 million for compensation and mitigation contingency related to environmental impacts	\$55 million includes \$50 million for mine capital and \$5 million for compensation and mitigation contingency related to environmental impacts
Separation and power plant	\$30 million	\$30 million
Railway construction	\$10 million	
Dedicated port & breakwater	\$25 million	
80km Road upgrade		\$88 million
Fort Brot port expansion		\$74 million
New fish landing site		\$3 million
Operating Costs		
Reclamation and reforestation	\$5 million/yr	\$5 million/yr
Mine operation	\$3.5 million/yr	\$3.5 million/yr
Road and other maintenance	\$3 million/yr	
Other Impacts		
Net forestry impacts		nil
Net fishery impacts		nil
Tourism benefits		\$5.85 million/yr Benefit
Reduced malaria costs		\$1.5 million/yr Benefit
Value-added processing		\$7.5 million/yr Benefit
Expected value of losses from shipping accident		\$100 (one hundred dollars)/yr Cost
Wetland degradation		\$15,730/yr Cost

Discussion of Project Revenues and Costs

Table 2 provides a summary of the main cost and revenue items for the project.

Project Revenues. Revenues under the two options are the same, and they correspond to an expected production of 350,000 tonnes of ilmenite annually. Real prices for this mineral are expected to remain stable over the period at today's price of US\$71.50/tonne. Power generation is expected to yield surplus power over the year of about 40 million kWh. Valued at a marginal cost of power supply to the government of 5¢/kWh, this has an imputed value of \$2 million annually. This is also the likely revenue that can be expected as the current average tariff for power is also at this level.

The total annual direct project revenues (benefits) from either of these two options is thus forecast to be \$27 million. Of this, the share to government under the revenue sharing agreement would be \$7 million.

Project Capital Costs. The total project capital costs under the two options is as follows:

Option A - \$120 million (Government share: \$30 million)

Option B - \$250 million (Government share: \$187.5 million)

The two options have the same common site constructions costs (\$55 million) and power plant costs (\$30 million). All of these required skilled or semi-skilled labour for construction. We note that these costs include a \$5 million environmental contingency that is consistent with the EIA findings that there may be some temporary impacts from initial site preparation. These funds are made available for the following: (i) primarily to provide mitigative expenditures (e.g., construction of bridges across ecologically sensitive streams); and, (ii) to pay damage compensation where mitigation was unsuccessful (e.g., for lost fishery catch, or damage to locally important forest stands).

Project Operating Costs. The total project operating costs under the two options is as follows:

Option A - \$8.5 million/yr (paid by company)

Option B - \$11.5 million/yr (paid by company)

The major component of this is the \$4 million to be spent annually on reclamation. This involves reclaiming the land and planting eucalyptus, consistent with the demonstration projects currently underway. The target of this plan is to create a “no net loss” situation that, in effect, results in a standing forest that is of higher quality than the existing forest. The slightly higher quality compensates for the loss of forest services from a small area for a short period of time.

Other Impacts. Project Option B will generate an **additional \$14.8 million annually in net benefits** attributable to the following associated impacts.

Forestry services (nil). As noted above, direct impacts will initially be compensated through the contingency fund and are thus treated directly as a project cost. Local use surveys indicated that the primary service derived from the trees themselves was for fuelwood. Adequate substitutability exists within the concession area to permit continued fuelwood harvesting in those areas not affected by the mining operation. The replanting program ensures that the ongoing demand for fuelwood will not be impacted by this project. Consequently, no net losses or benefits are anticipated.

Fishery impacts (nil). The project does not directly affect fishery catch. It does, however, call for a relocation of an existing landing site. The facilities will be located just outside of Fort Brot, close to the tourist area. The project design permits some of the funds to be used for improving access between Fort Brot and the new landing site. Discussions with some local fishing groups showed that some fishers feared that fish prices might be negatively impacted because the landing site was further from the local market (Fort Brot). While this may be true, the new landing site is closer to the higher valued “tourist market” associated with the resort hotels and restaurants in the nearby beach areas. It is assumed that these two influences will offset each other and that fishery revenue will remain unchanged.

Tourism services benefits (\$5.85 million/yr). Current tourism levels have remained at about 4000 people annually for the past 3 years. Extensive surveys were undertaken in the form of origin-destination studies, expenditure surveys, and a contingent

valuation survey to determine willingness to pay for forest ocelot viewing. Results of this analysis showed that one could expect a net increase of 18,000 tourists annually with an average length of stay of five nights. Average net values retained locally are \$50/night, suggesting a total value retained within the Fort Brot local industry of about \$250 a tourist. In addition, the CV survey showed that the expected willingness to pay for a half-day of ocelot viewing was \$75 a person; this is consistent with values derived elsewhere suggesting payments of \$50 to \$150 a person for viewing charismatic species such as mountain gorillas, chimpanzees, and rockhopper penguins. We therefore assign a net capturable tourism value of \$325 a person to these 18,000 visitors. We note that potential cruise ship “day” passengers are omitted from this.

Malaria reduction benefit (\$1.5 million/yr). Current malaria incidence in the coastal area is about 1000 cases a month. The typical impact is 2 weeks of lost productivity a case, and the sufferer incurs some expense for medication. A cost of illness analysis suggests that average impacts are \$125/case. The total benefit of malaria eradication (linked to draining and filling in the wetland where the fish landing site will be built) is thus \$1.5 million/yr.

Value added processing (\$7.5 million/yr). Revitalization of agricultural crops will provide a significant benefit to the region. Crops that are currently uneconomic because of high transportation costs or lack of markets will now become viable because of improved road infrastructure. Value-added processing of these commodities for export or domestic sale will further enhance these opportunities. The analysis suggests that some 30,000 ha will be affected with net gains of approximately \$250/ha/yr.

Accident risk (negligible). Risk to the marine and coastal habitat is of considerable concern within the region. A risk analysis of shipping activity was undertaken to determine the potential for the occurrence of a “system level threat” (e.g., substantial spill from grounding or accident). Parameters within the model reflected that the port would be used 40% of the time for industrial activities related to ilmenite export, 20% by tourism related services, and 40% by other cargo import and export. Local weather and current conditions were incorporated to determine spread of impacts. Ten million simulations of a typical day of activity were modelled through computer simulation, which were in turn sampled at random to provide likely accident risks. Within this framework, the maximum probability of an accident being generated was approximately 0.001% in any given year of port operation. The values at risk were taken to be tourist values and fishery catch (a total annual value of approximately \$10 million), resulting in an expected annual value loss of \$100. This amount is treated as negligible within this analysis.

Wetland services losses (negligible). The wetlands that are planned to be infilled currently provide only a nursery function to the local coastal system. Benefit transfer literature suggests that such systems have a value of \$143/ha/yr. The total size of this coastal lagoon is relatively small – 110 ha – and the potential service lost is thus valued at just under \$16,000 annually. This amount is negligible in the overall analysis.

Results of Economic Analysis

In addition to the cost benefit analysis, an economic impact model was used to show the direct employment and production impacts if the project options on the local economy

(Table 3). Because Deli Province is a very “open economy” – permitting free flow of labour and other inputs – such results should be regarded as “order-of-magnitude” impacts. They clearly show, however, that Option B will have a far greater impact locally than will Option A.

Of greater interest from the viewpoint of economic efficiency, however, we now turn to the results of the social CBA. Table 4 summarizes these results for the two options under consideration.

Table 3.
Other Economic Impacts on Deli Province

	Option A	Option B
Construction Employment (person-years)	3,300	36,800
GDP Impact (% Growth)	+3.6%	+14.8%

Table 4. Results of Social Cost Benefit Analysis				
	Option A		Option B	
	MinComp	Mañanaland	MinComp	Mañanaland
Base Case Present Value at 10% Discount Rate				
Project Revenues	+ 123.99	+ 43.40	+ 123.99	+ 43.40
Project Capital Costs	– 67.82	– 22.61	– 47.10	– 141.30
- labour cost adjustment		nil		+ 30.90
Project Operating Costs	– 52.70	0.00	– 71.30	0.00
Forestry Impacts		negl.		negl.
Fishery Impacts				negl.
Tourism Benefits				+ 36.27
Health Benefits				+ 9.30
Value Added Processing Benefits				+46.50
Net Present Value - NPV (10%)	+ 3.47	+ 20.79	+ 5.60	+25.06
Other Performance Indicators				
NPV (5%)	+ 55.54	+ 55.23	+ 44.53	+126.70
NPV (15%)	– 17.06	+ 6.02	– 9.95	– 16.20
IRR	10.6%	19.1%	11.3%	12.5%

Conclusion

The cost benefit results show that, from the perspective of Mañanaland, either of the two options would be preferred to the status quo (no project). Of the two options, **Option B – the full integrated project – provides the greatest net social benefit using the Government’s current public investment guidelines.**

Mandelbrot Project

Individual Profile Sheets

*(for distribution only to participants - one sheet per
participant - suggest placing them in a sealed envelope
to maintain confidentiality)*

Individual Profile

Write your name here: _____

Role:

Chair - Deputy Minister of Economic Planning

General Description:

This person is tasked with chairing the meeting and is also representing the views of the central government. The central government will be guarantying 25% of the financing for this project. The government is formed after an election once every five years and is currently in year 2 of its term. Note that this Ministry, through the Mandelbrot Project Office, was also responsible for the review and approval of the Environmental Impact Assessment completed some time ago.

General Disposition:

In favour of project

Additional Description:

A key factor in this project is that it (i) can be a model for sustainable development elsewhere in the country and, (ii) it generates substantial royalty revenues to central government coffers over the project life.

Hints/Tips:

Negotiate revenue sharing with local government, if necessary.

Individual Profile

Write your name here:	_____
Role:	<u>Rapporteur - Chief Economist for the Global Development Bank</u>
General Description:	<p>The GDB is an international consortium of donors that will be donating through direct grant or soft loans up to 50% of the financing for the project. The Chief Economist is responsible for projects in Mañanaland plus 8 other countries in the region. His/her recommendation and observations at this meeting will likely play a pivotal role in whether the project moves forward. The chief economist must be satisfied that the project meets certain criteria of economic acceptability while also conforming to social and environmental policies and guidelines that govern the GDB.</p>
General Disposition:	Generally in favour of this project or a close alternative.
Additional Description:	<p>Mañanaland in fact has very few projects on the drawing boards that are as far advanced in the planning stages as this one. If this project does not proceed, donor funds can not find a ready home in another project.</p> <p>Please do try to make sure that the meeting comes to some sort of decision.</p> <p>Also, note that the GDB generally does not like free trade zones (FTZs) as they distort trade. You are, however, powerless in preventing the government from establishing one should it take that route.</p>
Hints/Tips:	In addition to this, you also have \$1 million available in grants at your discretion for “soft” projects (institutional capacity building, education, ...). Be creative with this if the opportunity arises.
Warning!!	<p>You should be aware that the cash flow sustainability of this entire project is rather shaky unless the donors are willing to give substantial concessions. In effect, the donor contribution will be about \$125 million but the government share of royalties is \$7 million a year. This gives a maximum real discount rate of 2.55% if all monies are dedicated to servicing the loan. Typical donor strategies in this instance would be: (i) provide some as direct grant; (ii) provide a 10 year interest free holiday on remainder before invoking commercial rates (LIBOR). You do <u>not</u> want to dedicate 100% of the royalty payments to the debt ... The upside is that the revenue and production forecasts are definitely very conservative (i.e., on the low end).</p> <p>The cash flow question may become an issue, especially if revenue sharing between central and local government becomes contentious.</p>

Individual Profile

Write your name here: _____

Role: Consultant - Dr Econo, President of Anthropophobic Consulting Group

General Description: ACP is the firm that wrote the economic analysis report. Dr Econo did not, however, have any hands-on experience with the report, which was prepared by two of the firm's senior staff. Dr Econo knows all about economic analysis, but is not necessarily that familiar with the actual study results. Nonetheless, he/she will defend the results and will try to answer general questions if asked.

General Disposition: Favourable for project, but in fact has no say.

Additional Description: Dr Econo will be defending the integrity of the work and generally will need to blame any ambiguities in this study on others. Some useful things to keep in mind are that some of the elements of the project description provided by the mining company were not totally complete because they were "corporate secrets". This applied, for example, especially to mining processes and to revenue forecasts. (For your information, the revenue forecast that the mining company asked you to use was probably only one half the likely maximum revenue/production achievable from this concession. ... but nobody except the mining company representative knows this).

Your firm, by the way, is wholly owned by a larger Engineering, Procurement and Construction firm that could be considered in the bidding for the eventual work.

Hints/Tips: You are here mainly to answer questions as a resource person but your secondary agenda is to try to get more work out of this for your firm, either on this project or others, and to keep your parent firm in a positive light.

Individual Profile

Write your name here: _____

Role: Governor of Deli/Mayor of Fort Brot

General Description: This is the most senior position in the Province, and is an appointee of the Central Government through the Ministry of Local Government. Local government has recently received constitutional powers of indirect taxation and revenue collection, while also being responsible for monitoring and enforcing land use planning and environmental compliance.

General Disposition: Favourable for project but open to being persuaded differently

Additional Description: You like this project because of the immediate development impacts from construction. You are concerned about the long-term monitoring obligations and costs associated with that. Although you have taxation authority, under the Mines Act all resource royalties and income from power generation (about \$7 million total annually!) go to the Central Government and this means you have no funds available from that source.

Hints/Tips: Explore taxation and revenue sharing alternatives.

Individual Profile

Write your name here: _____

Role: President, Chamber of Commerce

General Description: This is an industry representative. The local chamber of commerce includes all private sector commercial and industrial players, including agricultural processing firms, sawmill operators, and other industrial (non-mining) operations.

General Disposition: Your membership is in favour of full project.

Additional Description: Your main concerns are related to the value added activities along the improved road corridor.

Hints/Tips: Compare project alternatives carefully.

Individual Profile

Write your name here: _____

Role: President Hotel and Tourist Association

General Description: This is a representative for the local hospitality industry. The association membership currently includes 10 hotels/motels, 43 restaurants, the national airline, 3 private tour operators, 2 sport fishing boat charter operators, a scuba dive shop, and an operator of a semi-submersible submarine that takes tourists out to see the coral reefs in the Deli Archipelago.

General Disposition: Your membership is split on this and you will need to make up your own mind.

Additional Description: Many members of your organization have argued in favour of this project because of the large number of tourists that are expected to arrive, especially as Deli Park access is improved. The naysayers have focused on risk to the island archipelago, and to the potential for tourism/fisher conflicts when the fishing landing site is moved.

You are quite supportive of the idea that the wetland needs to be filled in as it is currently a breeding ground for malaria, which hinders tourism development.

Hints/Tips: Look for compensation mechanisms. Is the current inventory of hotels etc. running at full capacity?

Individual Profile

Write your name here: _____

Role: Head of Fishery Co-operative

General Description: The fishery co-operative has been established for 15 years through domestic and foreign assistance. A marketing co-operative has promoted artisanal demersal fishing, and recent construction of a cold storage unit in Fort Brot has reduced spoilage significantly. Fish has become an important and affordable staple protein in the diet of many people in the Province. Although fishing remains a small part of total GDP (<2%) it creates significant seasonal employment for young men who would otherwise have no work. Establishment of the Port will require deepening the harbour and will increase the threat of pollution in critical fishing grounds; the fishery landing site and associated cold storage units will need to be moved to a new fishery landing site to be constructed just outside of Fort Brot, close to (but not on) some of the prime tourist beaches. Construction of the landing site will involve filling in a wetland that is now a breeding ground for anopheles mosquitoes (carrier of malaria).

General Disposition: Opposed to project

Additional Description: Most of the fishers in your coop do not like the prospects of being moved. The new location is less convenient for them to sell fish.

Hints/Tips: Consider the analytical assumptions behind the "fishing impact" result.

Individual Profile

- Write your name here: _____
- Role: Local Representative of World Environment Union
- General Description: The WEU is an Environmental NGO that has been active in the region for 20 years. Its efforts, funded through international donations and local volunteerism, were largely responsible for the establishment of the Deli National Park (inland) and the local marine park in the Deli Archipelago. It promotes sustainable development of local resources. The WEU currently operates the marine park in the Deli Archipelago, until such time as a more permanent management authority is established. WEU is also implementing the Deli National Park development project that will see greater tourism access to the inland park areas.
- General Disposition: No strong position evident. (i.e., neither strongly in favour nor strongly opposed)
- Additional Description: This project generates strong opportunities as well as non-trivial threats. Deli Park would be a beneficiary, although the archipelago would be placed at risk. The wetland issue is a difficult one because it is locally significant yet also creates health problems.
- Note that you are also in charge of a small project, The Deli National Park development project. This is a donor funded grant of \$2 million over 4 years to improve access and facilities *within* the park setting to some of the sites that are of greatest touristic interest (an animal “encounter” spot, a waterfall, and a cultural site around the remains of the original Deli Village). This project does not address facilities outside of the park boundary.
- Hints/Tips: Look for and suggest some precautionary mechanisms.

Individual Profile

Write your name here: _____

Role:

Chief of New Deli Village

Description:

This village and its surrounding area has 3000 inhabitants and was previously called simply Deli Village and was next to what is now the National Park. Upon establishment of the Park, Deli and its inhabitants were resettled 50 kilometers east and were provided with fresh farming land, homes, a school, and a medical clinic. The villagers rely, as do other villages in the region, on the forested area of the proposed mining concession for their fuel wood and other NTFPs. One year after their resettlement, exploration and development was commenced on the proposed mining area. A young child was recently killed in the village when playing with explosives found near an abandoned exploratory test hole. Young women in the village have been caught up in small-scale prostitution, and the incidence of sexually transmitted diseases is on the rise. Recent clashes have occurred between mine workers (who are semi-skilled labourers involved in exploration efforts, but are not from the area) and local villagers (who are trying to fish in local streams). These factors have given rise to a local movement opposing the mining project.

General Disposition:

Opposed to project

Hints/Tips:

Consider shadow prices, revenue assumptions. Look for allies. Pay attention to the *direction* of mine development.

Individual Profile

Write your name here: _____

Role: Officer from Ministry of Forests, Agriculture and Fisheries

General Description: This person is responsible for all regulations pertaining to agricultural land use, forestry and fisheries in Deli province. The local government office in this case consists of 3 people: this officer, a secretary, and a driver. The office currently has adequate funding for salaries, and for the operation and maintenance of some equipment; but for little else.

General Disposition: Undecided

Additional Description: Your work load may increase because of this. This is, however, an opportunity for you to seek more funding for some of your activities. Your job and salary scale are set at the central government level and will be unaffected by this project; as with most other civil servants in the country, your job is guaranteed for life.

Hints/Tips: Consider some revenue sharing opportunities, should these arise.

Individual Profile

Write your name here: _____

Role: Mining Company (MinComp) Representative

General Description: This person is in fact a lawyer and knows very little about the specific mining operations or plans at this site. He/she is here as an observer and is prepared to speak to any past incidents that may have occurred at the mine site. The representative will consistently restate their commitment to meeting local and international standards for safety and environmental issues. The person is not empowered with any ability to make commitments on behalf of the company.

General Disposition: Favourable

Additional Description: You are here mainly to answer questions. You will generally oppose any means to extract more money (via royalties, expenditures, etc.) from the project. The reason for this, you may cite, is that the project is just barely commercially viable from a corporate perspective with the existing taxation elements. (For your information, the revenue forecast that your company asked the consultant to use was very conservative: probably only one half the likely maximum revenue/production achievable from this concession ... but nobody except the consultant knows this).

Hints/Tips: Do not forget your excellent commitment to environment and social considerations to date!

Individual Profile

Write your name here: _____

Role: Deputy Minister of Transportation, Communications and Utilities

General Description: This person will be in charge of overseeing the public infrastructure development (roads and power) associated with the Mandelbrot Project.

General Disposition: No strong position evident.

Additional Description: You are in charge of a National Roads Vision that will see all of the provinces interconnected through a comprehensive network of roads over the next 15 years. This network would provide a better internal distribution mechanism for domestically produced goods, and would seek to lower food costs in major urban centres. The current alignment of the proposed roads within the Mandelbrot project are consistent with this Vision.

Hints/Tips: Look at long-term road cost recovery.

Individual Profile

Write your name here: _____

Role: MegaCorp Trading Representative

Description: This person represents a company that is a joint-venture partner with MinComp in other countries. MegaCorp advocates the establishment of free trade zones (FTZ) and this individual supports as large a development scheme as possible locally. MegaCorp has written a brief letter stating that it would underwrite one half of the Government financial commitment for the Mandelbrot project if it were in turn permitted to develop an exclusive free trade zone in association with the new port facilities at Fort Brot. The FTZ would include a commercial and industrial value added zone that was tax exempt.

General Disposition: Favourable

Hints/Tips: None

Mandelbrot Project

Convenor's Package

(for case study convenor only)

The Mandelbrot Project: A Case Study in Applied Decision-Making in Environmental Economics

Prepared by Jack Ruitenbeek*, for the Economy
and Environment Program for South East Asia
(EEPSEA), Singapore.

Introduction for Case Study Convenor

The Mandelbrot Development Project is a hypothetical development project in a developing country. The project design is based on typical circumstances in a hypothetical low-middle income country (Mañanaland), and draws on actual conditions from a cross-section of real-life projects in Sub-Saharan Africa, the Indian Ocean island states, the Indian sub-continent, Southeast Asia, and the Caribbean. The case study site features a coastal region (Deli Province) with typical bio-geographic and socio-economic conditions of high poverty levels, environmental degradation from deforestation and marginal agriculture, and an artisanal fishery industry. The area also features a recently established terrestrial biosphere reserve (Deli National Park) of international importance, and ecotourism around a marine park area (Deli Archipelago) is slowly being developed close to the sea-side provincial capital of Fort Brot. The Mandelbrot Project is composed of a number of regional development activities that include: (i) a mining project to extract ilmenite; (ii) a port expansion component required for the mining development; and, (iii) associated infrastructure.

The case study exercise provides a role-playing context (“game”) for students of environmental economics. The purpose of the exercise is not so much to have students undertake an environmental economics study, as it is for students to gain an understanding of the decision-making and policy formulation dynamics that often surround such studies.

Students are divided into groups of 10-15 people, with each person representing a “player” in the game. The players are invited to a half-day meeting to consider the development options for the province, and to determine whether the Mandelbrot project should (i) proceed immediately; (ii) proceed in some modified form; (iii) be abandoned; or (iv) be deferred until further research is done. The Project itself will be funded through the following formula: 25% private sector; 25% government contribution; 50% international assistance. All players in the game are given the same background information, which consists of an invitation to participate, a list of participants, and an economic consultant’s report. The meeting is chaired by a representative of Central Government who, in tandem with a representative from an international development agency, is tasked with garnering input from various stakeholders in the province.

* The author may be reached at: HJ Ruitenbeek Resource Consulting Limited, 875 Buttercup Road, Gabriola BC, Canada V0R1X5 Tel +1 250 2478436 Fax +1 250 2478492 <hjr@island.net> URL: <http://www.island.net/~hjr>

Goals of the Exercise

The pedagogical goals of the exercise are as follows:

- a) demonstrate that the same economic analysis can be used in different ways by different players. The policy implications of a given study are likely dependent on the positions and interests of respective stakeholders.
- b) demonstrate that cost benefit analysis (CBA) is just one of potentially many criteria that can be considered in a decision-making context.
- c) demonstrate that even a relatively thorough CBA and associated set of economic studies will often give imperfect and incomplete information for decision-making, and that decision-making will depend on different power relationships and other information.
- d) provide an opening point for discussing multi-criteria decision-making (MCDM) as a tool in policy formulation.

This is entitled the “Mandelbrot Project” to underline also the role of complex systems in such an exercise. Mandelbrot is largely credited with moving forward the science of complexity, and the links between order and chaos are receiving greater attention in all realms of analysis. The Mandelbrot set image (on the cover of this document) also demonstrates the infinite interleaving layers of order and chaos that come about from a simple mathematical expression.

Features of the Scenario

The following are key features of the development scenario:

- Mine development will be on a 7000 hectare area to collect and refine ilmenite, which is a heavy black mineral that mixes with surface soils and sand and is used in such items as paint, toothpaste, sunscreen, knee joints, and candy. It is mined using a “floating barge” technique that strips away the surface layers and redeposits spoils at or close to the mine location. The concession area is currently being deforested by unregulated fuelwood gathering. The mine operation will take down the existing forest, and will reforest it with sustainable woodlots during reclamation. The mine site development will include a refinery and a power plant. The power plant will generate surplus power that will flow back into the local grid.
- The export of the ilmenite requires expanding the existing port in Fort Brot (40 kilometers away) to accommodate the higher volumes. Port expansion will require that a fishing landing site be moved and that a wetland be filled in. The resulting port expansion and associated road infrastructure will improve marketing prospects for what is currently a marginal agricultural sector in the province. It will also improve tourism access to the National Park (the new road from Fort Brot to the mine site will cut through one section of the Park.)
- A major concern is the impacts of the development on the Deli Archipelago, which is a national asset for its small islands and associated reefs. It is receiving world wide attention as prime tourist development site and, although the port does not directly impact it, the archipelago lies directly in the path of all marine traffic using this port.

General Package

A “General Package” that is distributed to all participants contains the following:

- a) introductory note. This is a covering note stating that the materials for the plenary exercise are enclosed.
- b) invitation. This is a generic form letter from the Minister of Economic Planning to the various players, inviting them to participate in the exercise. It outlines the goals of the meeting and the decision options.
- c) participant list and general profiles. This is a list of the participants in the exercise. It includes 10 mandatory functional roles and some extra “optional” players. The number of players may be as high as 20 because some of the given “roles” may potentially be represented by a “delegation” of more than one individual. For each participant a brief “profile” is presented so that all of the players have a common understanding of the roles represented.
- d) addendum letter. This is from one of the participants who is advocating establishment of a free trade zone in this area.
- e) consultant report. This is a “Management Summary” report that includes a description of the site, and the project options. It provides environmental economic analyses of certain values at risk, as well as economic costs of various development options. It also provides limited results of employment impacts and of potential GDP impacts. It uses conventional CBA protocols and presents a distribution of costs and benefits according to various productivity centres. The report also comments generally on risks and uncertainties, and lists some “unquantifiable” costs. The base case of the report shows that the full Mandelbrot Project is economically justifiable. Enough information is also provided, however, that one might argue on economic grounds for any of the potential development alternatives through (for example), changing the shadow price of labour, choosing a precautionary approach, or choosing welfare weights in an MCDM framework. The consultant’s report states that it was cost-shared over a one-year study period with contributions from the Government, foreign donor agencies, and the mining company itself.

Individual Package

In addition to the common material described above, each individual player will receive a one-page “profile sheet” that gives them some further information about their role. In some cases it also provides some vague “hints” or “tips” (that only they will see), that may be helpful to them in promoting their own positions.

Conduct

The distribution of the material and the conduct of the exercise should reflect the following:

- materials should be circulated a day or two before the actual meeting. Participants should have well-defined pre-assigned roles, with latecomers joining as delegations or ‘optional’ players. Participants should be encouraged to discuss their roles and form alliances before the meeting.
- meeting conduct should permit the chair to convene the meeting and run it as he/she sees fit. The rapporteur of the meeting is, in fact, a representative from the international donor community. A suggested agenda for convening the meeting will be as follows:

- individual presentations. Each person will be invited to make a 3-5 minute presentation stating their preferred option and referring to the study results.
 - general discussion. To be facilitated by the chair.
 - general resolutions. The goal of the meeting is to provide a clear recommendation to the Central Government and to the international donor community.
- if there is more than one concurrent case study being conducted, all participants can convene for a brief plenary session to share conclusions and observations.

Other

The following page provides a worksheet to assist the convenor in assigning the roles to individual participants. Upon completion, it may also be distributed to all participants or posted in a conspicuous place such that individuals can have an opportunity to interact before the meeting.

Mandelbrot Project Meeting

Group: _____ (if more than one group)

Date: _____

Time: _____

Place: _____

Role	Participant(s) Assigned
Chair - Deputy Minister of Economic Planning	
Rapporteur - Chief Economist for the Global Development Bank	
Consultant - Dr Econo, President of Anthropophobic Consulting Group	
Governor of Deli/Mayor of Fort Brot	
President, Chamber of Commerce	
President Hotel and Tourist Association	
Head of Fishery Co-operative	
Local Representative of World Environment Union	
Chief of New Deli Village	
Officer from Ministry of Forests, Agriculture and Fisheries	
Mining Company (MinComp) Representative	
Deputy Minister of Transportation, Communications and Utilities	
MegaCorp Trading Representative	

Mandelbrot Project

General Package

(for distribution to all participants)

Dear EEPSEA Participant,

RE: Case Study - Mandelbrot Project

As a change of pace, a case study has been prepared by Jack Ruitenbeek that involves a role-playing session. During this session, each person will take on a different “role” during a decision meeting on a hypothetical development project - The Mandelbrot Project. In this package you will find an invitation to participate, a background consultant’s report, and other material you may find useful in preparing for the meeting.

The Mandelbrot Development Project is a hypothetical development project in a developing country. The project design is based on typical circumstances in a hypothetical low-middle income country (Mañanaland), and draws on actual conditions from a cross-section of real-life projects in Sub-Saharan Africa, the Indian Ocean island states, the Indian sub-continent, Southeast Asia, and the Caribbean. The case study site features a coastal region (Deli Province) with typical bio-geographic and socio-economic conditions of high poverty levels, environmental degradation from deforestation and marginal agriculture, and an artisanal fishery industry. The area also features a recently established terrestrial biosphere reserve (Deli National Park) of international importance, and ecotourism around a marine park area (Deli Archipelago) is slowly being developed close to the sea-side provincial capital of Fort Brot. The Mandelbrot Project is composed of a number of regional development activities that include: (i) a mining project to extract ilmenite; (ii) a port expansion component required for the mining development; and, (iii) associated infrastructure. The following are key features of the development scenario:

- Mine development will be on a 7000 hectare area to collect and refine ilmenite, which is a heavy black mineral that mixes with surface soils and sand and is used in such items as paint, toothpaste, sunscreen, knee joints, and candy. It is mined using a “floating barge” technique that strips away the surface layers and redeposits spoils at or close to the mine location. The concession area is currently being deforested by unregulated fuelwood gathering. The mine operation will take down the existing forest, and will reforest it with sustainable woodlots during reclamation. The mine site development will include a refinery and a power plant, which will generate surplus power that will flow back into the local grid.
- The export of the ilmenite requires expanding the existing port in Fort Brot (40 km away) to accommodate the higher volumes. Port expansion will require that a fishing landing site be moved and that a wetland be filled in. The resulting port expansion and associated road infrastructure will improve marketing prospects for what is currently a marginal agricultural sector in the province. It will also improve tourism access to the National Park (the new road from Fort Brot to the mine site will cut through one section of the Park.)
- A major concern is the impacts of the development on the Deli Archipelago, which is a national asset for its small islands and associated reefs. It is receiving world wide attention as prime tourist development site and, although the port does not directly impact it, the archipelago lies directly in the path of all marine traffic using this port.

The purpose of the exercise is not to undertake an environmental economics study, but to use an existing study within the context of a typical decision-making framework. It is hoped that you will gain some insights into how such studies can be used by different people, as well as appreciation for some of the policy formulation dynamics that often surround such studies.

In your package you will also find an “individual profile” that gives you a bit more background on your individual role. It also provides some hints and tips that you may want to consider as you prepare for the meeting. (Others will have received different tips so guard your own closely!)

Please note also that, at the beginning of the meeting, everybody will be invited to make a short statement or presentation regarding their position.

Have fun!

November 2000

From the desk of:

Mandelbrot Project Office, Ministry of Economic Planning

Box 3120

Mangoville, Mañanaland

06 November 2000

Dear colleague,

RE: Roundtable Review and Decision Meeting - 22 November 2000
Mandelbrot Project, Deli Province

You are hereby invited to the above meeting to discuss the captioned Project.

As you are no doubt aware, the Mandelbrot Project Office was established in 1997 to conduct a series of work programs associated with investigating the feasibility of pursuing that Project. At that time, MinComp Ltd. was given conditional approval to proceed with the project subject to their securing financing and conducting associated environmental impact and socio-economic assessments through a public process. The environmental impact statement was completed in mid-1999 and has been reviewed internally by the Project Office and has been found to be in compliance with national requirements; it describes the mitigative measures that would be undertaken as part of the project for environmental controls.

At that time, MinComp also secured funding for its equity contribution to the Project, and indicated that it would need a "go" or "no-go" decision from the Government by 30 June 2000. That date has subsequently been extended to 31 December 2000 to permit completion of some economic studies, and we are informed that this final deadline is now no longer extendable.

Over the past year, an economic study was thus made of the socio-economic impacts of the project, as well as some project alternatives. The Management Summary of the study is enclosed.

The purpose of the meeting is to discuss the findings and recommendations of the economic study, and to decide on the next steps in the Project Approval Process. Based on input received at this meeting, the Government will decide whether to: (a) approve the Project as defined; (b) propose a modified Project; or (c) abandon the Project.

The agenda for the meeting will permit each individual participant up to 5 minutes at the outset to put forward their position or to comment on parts of the Consultant's report that are relevant to them. Following that, there will be a general discussion. The final goal of the meeting is to provide a clear recommendation to the Central Government and to the international donor community.

As I will be unable to attend that day, our servant the Deputy Minister of Economic Planning will chair the meeting in my place. Also in attendance will be the Chief Economist of the Global Development Bank, which is coordinating the foreign donor effort that will potentially contribute 50% of the financing to the project.

Hail Mañanaland!

General IMA Mangosaur

Participant Profiles

Chair - Deputy Minister of Economic Planning. This person is tasked with chairing the meeting and is also representing the views of the central government. The central government will be guarantying 25% of the financing for this project. The government is formed after an election once every five years and is currently in year 2 of its term. Note that this Ministry, through the Mandelbrot Project Office, was also responsible for the review and approval of the Environmental Impact Assessment completed some time ago.

Rapporteur - Chief Economist for the Global Development Bank (GDB), an international consortium of donors that will be donating through direct grant or soft loans up to 50% of the financing for the project. The Chief Economist is responsible for projects in Mañanaland plus 8 other countries in the region. His/her recommendation and observations at this meeting will likely play a pivotal role in whether the project moves forward. The chief economist must be satisfied that the project meets certain criteria of economic acceptability while also conforming to social and environmental policies and guidelines that govern the GDB.

Consultant - Dr Econo, President of Anthropophobic Consulting Group: the firm that wrote the economic analysis report. He/she did not, however, have any hands-on experience with the report, which was prepared by two of the firm's senior staff. Dr Econo knows all about economic analysis, but is not necessarily that familiar with the actual study results. Nonetheless, he/she will defend the results and will try to answer general questions if asked.

Governor of Deli/Mayor of Fort Brot. This is the most senior position in the Province, and is an appointee of the Central Government through the Ministry of Local Government. Local government has recently received constitutional powers of indirect taxation and revenue collection, while also being responsible for monitoring and enforcing land use planning and environmental compliance.

President, Chamber of Commerce. This is an industry representative. The local chamber of commerce includes all private sector commercial and industrial players, including agricultural processing firms, sawmill operators, and other industrial (non-mining) operations.

President Hotel and Tourist Association. This is a representative for the local hospitality industry. The association membership currently includes 10 hotels/motels, 43 restaurants, the national airline, 3 private tour operators, 2 sport fishing boat charter operators, a scuba dive shop, and an operator of a semi-submersible submarine that takes tourists out to see the coral reefs in the Deli Archipelago.

Head of Fishery Co-operative. The fishery co-operative has been established for 15 years through domestic and foreign assistance. A marketing co-operative has promoted artisanal demersal fishing, and recent construction of a cold storage unit in Fort Brot has reduced spoilage significantly. Fish has become an important and affordable staple protein in the diet of many people in the Province. Although fishing remains a small part of total GDP (<2%) it creates significant seasonal employment for young men who would otherwise have no work. Establishment of the Port will require deepening the harbour and will increase the threat of pollution in critical fishing grounds; the fishery landing site and associated cold storage units will need to be moved to a new fishery landing site to be constructed just outside of Fort Brot, close to (but not on) some of the prime tourist beaches. Construction of the landing site will involve filling in a wetland that is now a breeding ground for anopheles mosquitoes (carrier of malaria).

Local Representative of World Environment Union. The WEU is an Environmental NGO that has been active in the region for 20 years. Its efforts, funded through international donations and local volunteerism, were largely responsible for the establishment of the Deli National Park (inland) and the local marine park in the Deli Archipelago. It promotes sustainable development of local resources. The WEU currently operates the marine park in the Deli Archipelago, until such time as a more permanent management authority is established. WEU is also implementing the Deli National Park development project that will see greater tourism access to the inland park areas.

Chief of New Deli Village. This village and its surrounding area has 3000 inhabitants and was previously called simply Deli Village and was next to what is now the National Park. Upon establishment of the Park, Deli and its inhabitants were resettled 50 kilometers east and were provided with fresh farming land, homes, a school, and a medical clinic. The villagers rely, as do other villages in the region, on the forested area of the proposed mining concession for their fuel wood and other NTFPs. One year after their resettlement, exploration and development was commenced on the proposed mining area. A young child was recently killed in the village when playing with explosives found near an abandoned exploratory test hole. Young women in the village have been caught up in small-scale prostitution, and the incidence of sexually transmitted diseases is on the rise. Recent clashes have occurred between mine workers (who are semi-skilled labourers involved in exploration efforts, but are not from the area) and local villagers (who are trying to fish in local streams). These factors have given rise to a local movement opposing the mining project.

Officer from Ministry of Forests, Agriculture and Fisheries. This person is responsible for all regulations pertaining to agricultural land use, forestry and fisheries in Deli province. The local government office in this case consists of 3 people: this officer, a secretary, and a driver. The office currently has adequate funding for salaries, and for the operation and maintenance of some equipment; but for little else.

Mining Company (MinComp) Representative*. This person is in fact a lawyer and knows very little about the specific mining operations or plans at this site. He/she is here as an observer and is prepared to speak to any past incidents that may have occurred at the mine site. The representative will consistently restate their commitment to meeting local and international standards for safety and environmental issues. The person is not empowered with any ability to make commitments on behalf of the company.

Deputy Minister of Transportation, Communications and Utilities*. This person will be in charge of overseeing the public infrastructure development (roads and power) associated with the Mandelbrot Project.

MegaCorp Trading Representative*. This person represents a company that is a joint-venture partner with MinComp in other countries. MegaCorp advocates the establishment of free trade zones (FTZ) and this individual supports as large a development scheme as possible locally. MegaCorp has written a brief letter (attached) stating that it would under-write one half of the Government financial commitment for the Mandelbrot project if it were in turn permitted to develop an exclusive free trade zone in association with the new port facilities at Fort Brot. The FTZ would include a commercial and industrial value added zone that was tax exempt.

*Invited but attendance is not mandatory.

November 2000

MegaCorp Inc.

"Free Trade for World Peace"

Freeport, Union Islands 45612

04 November 2000

Minister IMA Mangosaur

Mandelbrot Planning Office, Ministry of Economic Planning

Box 3120

Mangoville, Mañanaland

Dear Minister,

Please be advised that we have reviewed the project documents and various proposals associated with the Mandelbrot Project.

We believe that the proposed port expansion facilities at Fort Brot will create significant economic benefits for your nation. We also believe that this expansion just opens the door to even greater employment opportunities. We have conducted extensive analyses of trade profiles within the geographic region and we believe that Fort Brot would be an ideal candidate for a free trade zone (FTZ).

We are therefore prepared to commit up to one-half of the government's share of the funding to this project in exchange for the following:

- establishment of a free trade zone within 5 km of the Fort Brot Port facility. The zone may include industrial or commercial activities, including value-added processing of imported items.
- activities within the zone will enjoy duty-free import of goods, as well as tax exempt export. No income taxes will be payable on that part of a firm's profits that derives from activities within the FTZ.
- firms within the FTZ will pay user fees (on a cost recovery basis) for services that are provided by the government or nearby municipalities (e.g., water, communications, power, sewage treatment).

We understand that you will be having a decision-meeting regarding this project shortly and hope that you will look favourably on our offer. If requested, a representative from our firm can be available for that meeting.

Yours sincerely,

Trader Vic, President

Background Report

[Consultant's Report to be inserted here from separate file.]

Mandelbrot Project

Individual Profile Sheets

(for distribution only to participants - one sheet per participant - suggest placing them in a sealed envelope to maintain confidentiality)

Individual Profile

Write your name here: _____

Role: Chair - Deputy Minister of Economic Planning

General Description: This person is tasked with chairing the meeting and is also representing the views of the central government. The central government will be guarantying 25% of the financing for this project. The government is formed after an election once every five years and is currently in year 2 of its term. Note that this Ministry, through the Mandelbrot Project Office, was also responsible for the review and approval of the Environmental Impact Assessment completed some time ago.

General Disposition: In favour of project

Additional Description: A key factor in this project is that it (i) can be a model for sustainable development elsewhere in the country and, (ii) it generates substantial royalty revenues to central government coffers over the project life.

Hints/Tips: Negotiate revenue sharing with local government, if necessary.

Individual Profile

Write your name here: _____

Role: Rapporteur - Chief Economist for the Global Development Bank

General Description: The GDB is an international consortium of donors that will be donating through direct grant or soft loans up to 50% of the financing for the project. The Chief Economist is responsible for projects in Mañanaland plus 8 other countries in the region. His/her recommendation and observations at this meeting will likely play a pivotal role in whether the project moves forward. The chief economist must be satisfied that the project meets certain criteria of economic acceptability while also conforming to social and environmental policies and guidelines that govern the GDB.

General Disposition: Generally in favour of this project or a close alternative.

Additional Description: Mañanaland in fact has very few projects on the drawing boards that are as far advanced in the planning stages as this one. If this project does not proceed, donor funds can not find a ready home in another project.

Please do try to make sure that the meeting comes to some sort of decision.

Also, note that the GDB generally does not like free trade zones (FTZs) as they distort trade. You are, however, powerless in preventing the government from establishing one should it take that route.

Hints/Tips: In addition to this, you also have \$1 million available in grants at your discretion for “soft” projects (institutional capacity building, education, ...). Be creative with this if the opportunity arises.

Warning!! You should be aware that the cash flow sustainability of this entire project is rather shaky unless the donors are willing to give substantial concessions. In effect, the donor contribution will be about \$125 million but the government share of royalties is \$7 million a year. This gives a maximum real discount rate of 2.55% if all monies are dedicated to servicing the loan. Typical donor strategies in this instance would be: (i) provide some as direct grant; (ii) provide a 10 year interest free holiday on remainder before invoking commercial rates (LIBOR). You do not want to dedicate 100% of the royalty payments to the debt ... The upside is that the revenue and production forecasts are definitely very conservative (i.e., on the low end).

The cash flow question may become an issue, especially if revenue sharing between central and local government becomes contentious.

Individual Profile

Write your name here:	_____
Role:	<u>Consultant - Dr Econo, President of Anthropophobic Consulting Group</u>
General Description:	ACP is the firm that wrote the economic analysis report. Dr Econo did not, however, have any hands-on experience with the report, which was prepared by two of the firm's senior staff. Dr Econo knows all about economic analysis, but is not necessarily that familiar with the actual study results. Nonetheless, he/she will defend the results and will try to answer general questions if asked.
General Disposition:	Favourable for project, but in fact has no say.
Additional Description:	<p>Dr Econo will be defending the integrity of the work and generally will need to blame any ambiguities in this study on others. Some useful things to keep in mind are that some of the elements of the project description provided by the mining company were not totally complete because they were "corporate secrets". This applied, for example, especially to mining processes and to revenue forecasts. (For your information, the revenue forecast that the mining company asked you to use was probably only one half the likely maximum revenue/production achievable from this concession. ... but nobody except the mining company representative knows this).</p> <p>Your firm, by the way, is wholly owned by a larger Engineering, Procurement and Construction firm that could be considered in the bidding for the eventual work.</p>
Hints/Tips:	You are here mainly to answer questions as a resource person but your secondary agenda is to try to get more work out of this for your firm, either on this project or others, and to keep your parent firm in a positive light.

Individual Profile

Write your name here: _____

Role: Governor of Deli/Mayor of Fort Brot

General Description: This is the most senior position in the Province, and is an appointee of the Central Government through the Ministry of Local Government. Local government has recently received constitutional powers of indirect taxation and revenue collection, while also being responsible for monitoring and enforcing land use planning and environmental compliance.

General Disposition: Favourable for project but open to being persuaded differently

Additional Description: You like this project because of the immediate development impacts from construction. You are concerned about the long-term monitoring obligations and costs associated with that. Although you have taxation authority, under the Mines Act all resource royalties and income from power generation (about \$7 million total annually!) go to the Central Government and this means you have no funds available from that source.

Hints/Tips: Explore taxation and revenue sharing alternatives.

Individual Profile

Write your name here: _____

Role: President, Chamber of Commerce

General Description: This is an industry representative. The local chamber of commerce includes all private sector commercial and industrial players, including agricultural processing firms, sawmill operators, and other industrial (non-mining) operations.

General Disposition: Your membership is in favour of full project.

Additional Description: Your main concerns are related to the value added activities along the improved road corridor.

Hints/Tips: Compare project alternatives carefully.

Individual Profile

Write your name here: _____

Role: President Hotel and Tourist Association

General Description: This is a representative for the local hospitality industry. The association membership currently includes 10 hotels/motels, 43 restaurants, the national airline, 3 private tour operators, 2 sport fishing boat charter operators, a scuba dive shop, and an operator of a semi-submersible submarine that takes tourists out to see the coral reefs in the Deli Archipelago.

General Disposition: Your membership is split on this and you will need to make up your own mind.

Additional Description: Many members of your organization have argued in favour of this project because of the large number of tourists that are expected to arrive, especially as Deli Park access is improved. The naysayers have focused on risk to the island archipelago, and to the potential for tourism/fisher conflicts when the fishing landing site is moved.

You are quite supportive of the idea that the wetland needs to be filled in as it is currently a breeding ground for malaria, which hinders tourism development.

Hints/Tips: Look for compensation mechanisms. Is the current inventory of hotels etc. running at full capacity?

Individual Profile

Write your name here: _____

Role: Head of Fishery Co-operative

General Description: The fishery co-operative has been established for 15 years through domestic and foreign assistance. A marketing co-operative has promoted artisanal demersal fishing, and recent construction of a cold storage unit in Fort Brot has reduced spoilage significantly. Fish has become an important and affordable staple protein in the diet of many people in the Province. Although fishing remains a small part of total GDP (<2%) it creates significant seasonal employment for young men who would otherwise have no work. Establishment of the Port will require deepening the harbour and will increase the threat of pollution in critical fishing grounds; the fishery landing site and associated cold storage units will need to be moved to a new fishery landing site to be constructed just outside of Fort Brot, close to (but not on) some of the prime tourist beaches. Construction of the landing site will involve filling in a wetland that is now a breeding ground for anopheles mosquitoes (carrier of malaria).

General Disposition: Opposed to project

Additional Description: Most of the fishers in your coop do not like the prospects of being moved. The new location is less convenient for them to sell fish.

Hints/Tips: Consider the analytical assumptions behind the “fishing impact” result.

Individual Profile

Write your name here: _____

Role: Local Representative of World Environment Union

General Description: The WEU is an Environmental NGO that has been active in the region for 20 years. Its efforts, funded through international donations and local volunteerism, were largely responsible for the establishment of the Deli National Park (inland) and the local marine park in the Deli Archipelago. It promotes sustainable development of local resources. The WEU currently operates the marine park in the Deli Archipelago, until such time as a more permanent management authority is established. WEU is also implementing the Deli National Park development project that will see greater tourism access to the inland park areas.

General Disposition: No strong position evident. (i.e., neither strongly in favour nor strongly opposed)

Additional Description: This project generates strong opportunities as well as non-trivial threats. Deli Park would be a beneficiary, although the archipelago would be placed at risk. The wetland issue is a difficult one because it is locally significant yet also creates health problems.

Note that you are also in charge of a small project, The Deli National Park development project. This is a donor funded grant of \$2 million over 4 years to improve access and facilities *within* the park setting to some of the sites that are of greatest touristic interest (an animal "encounter" spot, a waterfall, and a cultural site around the remains of the original Deli Village). This project does not address facilities outside of the park boundary.

Hints/Tips: Look for and suggest some precautionary mechanisms.

Individual Profile

Write your name here: _____

Role: Chief of New Deli Village

Description: This village and its surrounding area has 3000 inhabitants and was previously called simply Deli Village and was next to what is now the National Park. Upon establishment of the Park, Deli and its inhabitants were resettled 50 kilometers east and were provided with fresh farming land, homes, a school, and a medical clinic. The villagers rely, as do other villages in the region, on the forested area of the proposed mining concession for their fuel wood and other NTFPs. One year after their resettlement, exploration and development was commenced on the proposed mining area. A young child was recently killed in the village when playing with explosives found near an abandoned exploratory test hole. Young women in the village have been caught up in small-scale prostitution, and the incidence of sexually transmitted diseases is on the rise. Recent clashes have occurred between mine workers (who are semi-skilled labourers involved in exploration efforts, but are not from the area) and local villagers (who are trying to fish in local streams). These factors have given rise to a local movement opposing the mining project.

General Disposition: Opposed to project

Hints/Tips: Consider shadow prices, revenue assumptions. Look for allies. Pay attention to the *direction* of mine development.

Individual Profile

Write your name here: _____

Role: Officer from Ministry of Forests, Agriculture and Fisheries

General Description: This person is responsible for all regulations pertaining to agricultural land use, forestry and fisheries in Deli province. The local government office in this case consists of 3 people: this officer, a secretary, and a driver. The office currently has adequate funding for salaries, and for the operation and maintenance of some equipment; but for little else.

General Disposition: Undecided

Additional Description: Your work load may increase because of this. This is, however, an opportunity for you to seek more funding for some of your activities. Your job and salary scale are set at the central government level and will be unaffected by this project; as with most other civil servants in the country, your job is guaranteed for life.

Hints/Tips: Consider some revenue sharing opportunities, should these arise.

Individual Profile

Write your name here: _____

Role: Mining Company (MinComp) Representative

General Description: This person is in fact a lawyer and knows very little about the specific mining operations or plans at this site. He/she is here as an observer and is prepared to speak to any past incidents that may have occurred at the mine site. The representative will consistently restate their commitment to meeting local and international standards for safety and environmental issues. The person is not empowered with any ability to make commitments on behalf of the company.

General Disposition: Favourable

Additional Description: You are here mainly to answer questions. You will generally oppose any means to extract more money (via royalties, expenditures, etc.) from the project. The reason for this, you may cite, is that the project is just barely commercially viable from a corporate perspective with the existing taxation elements. (For your information, the revenue forecast that your company asked the consultant to use was very conservative: probably only one half the likely maximum revenue/production achievable from this concession ... but nobody except the consultant knows this).

Hints/Tips: Do not forget your excellent commitment to environment and social considerations to date!

Individual Profile

Write your name here: _____

Role: Deputy Minister of Transportation, Communications and Utilities

General Description: This person will be in charge of overseeing the public infrastructure development (roads and power) associated with the Mandelbrot Project.

General Disposition: No strong position evident.

Additional Description: You are in charge of a National Roads Vision that will see all of the provinces interconnected through a comprehensive network of roads over the next 15 years. This network would provide a better internal distribution mechanism for domestically produced goods, and would seek to lower food costs in major urban centres. The current alignment of the proposed roads within the Mandelbrot project are consistent with this Vision.

Hints/Tips: Look at long-term road cost recovery.

Individual Profile

Write your name here: _____

Role: MegaCorp Trading Representative

Description: This person represents a company that is a joint-venture partner with MinComp in other countries. MegaCorp advocates the establishment of free trade zones (FTZ) and this individual supports as large a development scheme as possible locally. MegaCorp has written a brief letter stating that it would underwrite one half of the Government financial commitment for the Mandelbrot project if it were in turn permitted to develop an exclusive free trade zone in association with the new port facilities at Fort Brot. The FTZ would include a commercial and industrial value added zone that was tax exempt.

General Disposition: Favourable

Hints/Tips: None

The Mandelbrot Project, Mañanaland

An Economic Analysis

Prepared by the Anthropophobic Consulting Group

for

Mandelbrot Project Office
Ministry of Economic Planning
Mangoville, Mañanaland

November 2000

(Final Report – Management Summary)

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Study Background and Process

This study was conducted at the request of the Government of Mañanaland (GOM), over a one year period commencing in October 1999. Study funding was provided through a cost-sharing arrangement among the GOM, the international donor community, and the project proponent – MinComp Ltd. In 1999 an Environmental Impact Assessment (EIA) determined that the project could meet or exceed all national environmental guidelines. Subsequent to completion of the EIA, this study was undertaken to determine the overall economic desirability of the project.

The study's terms of reference required that it rely on conventional cost benefit analysis procedures to compare the major project alternatives put forward by the project proponent. In addition, the study used standard methods of environmental economic analysis to quantify a number of the environmental costs and benefits associated with the project. In undertaking this approach, the study relied on the following sources of information:

- direct project cost information was taken as provided by the proponent.
- associated infrastructure costs are consistent with infrastructure costs within Mañanaland, as reflected in the GOM 5 Year Budget last reviewed in 1998.
- estimates related to various unmarketed goods and services were based on household surveys undertaken in Deli Province, and on selected tourist surveys conducted over the past year.

In addition, the study relied on extensive consultations with local user groups to help determine relevant pricing and related assumptions for traded goods such as fishery products, future potential value added processing from agricultural commodities.

Description of Study Site and Project Area

The Mandelbrot Development Project is in the southern province of Deli. Some key economic indicators are presented in Table 1. The capital – Fort Brot – was historically an important colonial fortification that subsequently saw prominence as an export point for tropical hardwoods that covered most of the province. Over a period of some 50 years, most of the province was deforested, and plantation agriculture was established in some of the low-lying areas. Through a quirk of history, the colonial Governor of the area at the time was a cat lover and had arranged to set aside a 300km² private reserve where a rare species of forest ocelot made its home. After the Insurrection of 1962, colonial rule was transferred to domestic rule centred in Mangoville, and the economic importance of Fort Brot and Deli Province waned. Through the 1960s and 1970s, population of the Province grew at an average rate of 10% annually, largely because of in-migration from political instability elsewhere in the country. The new settlers tended to congregate along the coastal areas and in small villages throughout the secondary forest areas of the province. These

Table 1
Selected Economic Statistics

	Deli Province	National
Population 1999	375,000	8,400,000
Households 1999	75,000	1,680,000
Urban Population	70,000	2,750,000
Urbanization Rate	18.7%	32.7%
GNP million US\$ (est)	225	7,140
GNP/capita (\$US/yr)	\$600	\$850
GDP - Agriculture (%)	n.e.	32
GDP - Industry (%)	n.e.	17
GDP - Services (%)	n.e.	51
(n.e. - no estimate)		

forests were eventually also reduced to scrub forest as they were replaced by small-scale marginal agriculture. While the population influx eventually abated, the area is still one of the least developed within the country.

Through the 1980s, it was realised that the natural beauty of the area was perhaps its greatest asset. With the assistance and efforts of local NGOs and international environmental interests, the Deli National Park was established to protect the habitat of the famed forest ocelot. Adventure tourism to this area grew rapidly, and Deli Province soon discovered that it had an internationally marketable combination of tourist assets all within a short distance of Fort Brot. The Deli Archipelago – a group of islands with associated coral reefs – has since been declared a World Heritage Site for its marine diversity. Tourists visiting the area can now avail themselves of visits to the National Park, boat trips to the islands for snorkelling or diving, or unlimited sunbathing along 15 kilometers of beach just to the north of Fort Brot. The major constraints to further development in this area are as follows:

- a) Fort Brot itself is unattractive to most tourists because of its derelict port and run down urban conditions. Most new development has occurred preferentially near the beaches, and the tourists tend to stay in those areas.
- b) road travel within the province – and to Deli Park in particular – remains slow and dangerous because of poor road conditions.
- c) malaria remains a problem in the coastal areas.

The province has thus been struggling in its attempts to extricate itself from this situation. Foreign assistance has been available, but it has been limited and in any event it has been distributed by the Central Government to all of the provinces on a relatively equal basis. In the case of Deli Province, the foreign assistance has been directed primarily into the following areas: (i) social sector improvements for upgrading local schools and medical clinics; (ii) a rural electrification project that now supplies 50% of the population with electricity; (iii) an infrastructure project that provided for limited road rehabilitation and safety equipment for the local airport at Fort Brot; and, (iv) a fishery enhancement project that provided cold storage facilities and a fishery landing site in the heart of Fort Brot harbour.

In early 1990, however, another potential opportunity arose. A geologist visiting the area as a tourist noticed that the white beach sand contained some interesting black flecks. She hired a local fisherman to take her further up the coast and discovered the greatest concentration of these flecks to be some 50 km north. Packing some of the sand home with her, she later analyzed the black flecks as ilmenite, which is a heavy black mineral that mixes with surface soils and sand and is used in such items as paint, toothpaste, sunscreen, artificial knee joints, and candy. She ended up selling this prospecting information to MinComp Ltd., which produces some 25% of the world supply of ilmenite; MinComp in 1991 secured mining concessions from GOM over some 150 km² of Deli Province. The concession lies in one of the last remaining secondary forests in Deli Province. Subsequent exploratory work confirmed rich deposits within this zone, and in 1997 the GOM had given MinComp conditional approval to proceed with project development, subject to a satisfactory EIA and secured funding arrangements.

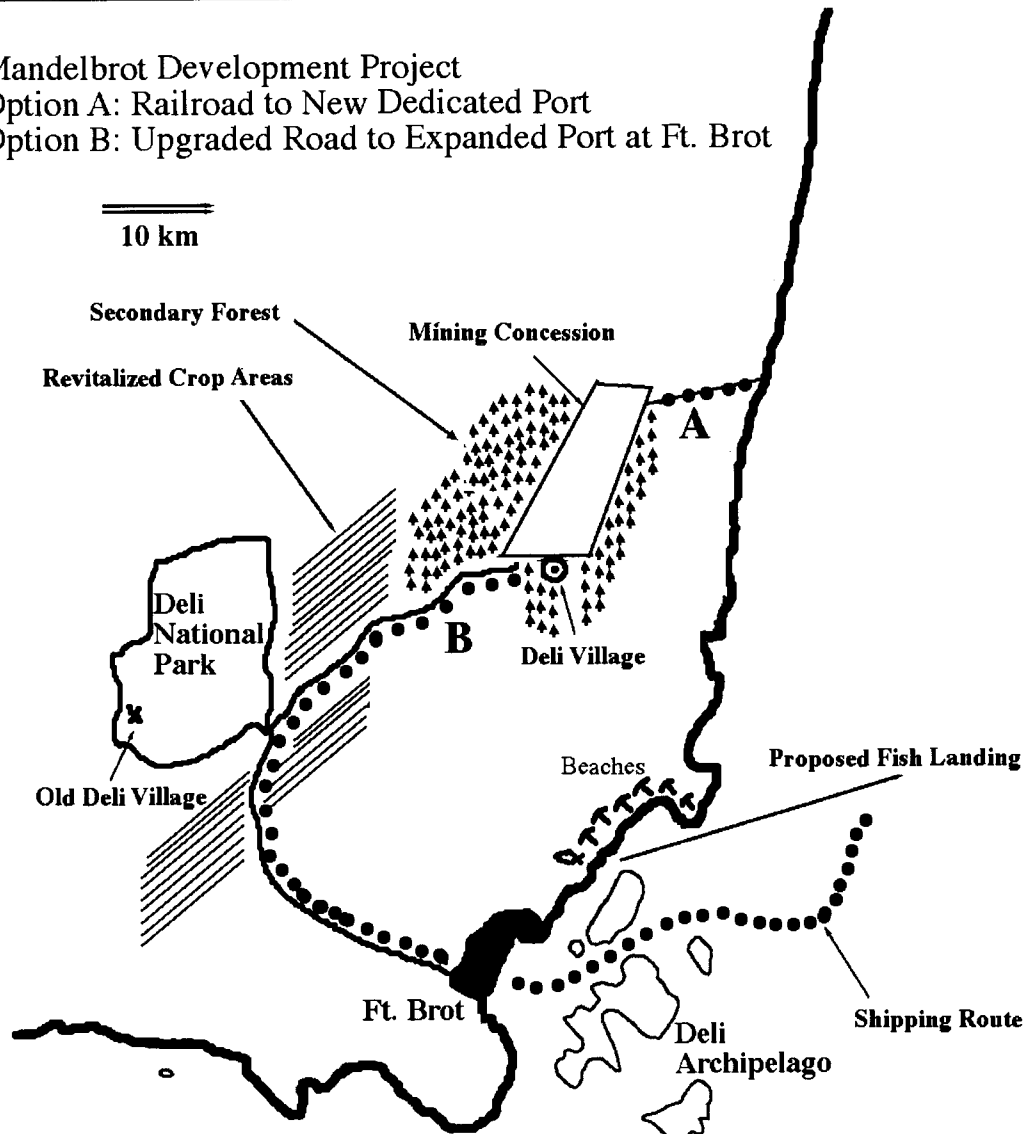
A map of the area is shown in Figure 1.

Figure 1.

Mandelbrot Development Project

Option A: Railroad to New Dedicated Port

Option B: Upgraded Road to Expanded Port at Ft. Brot

**General Description of Project Alternatives**

The mine development plan for this project consists of a 25 year extraction project that involves the collection and separation of ilmenite using a "floating barge technique." Ilmenite occurs in the near surface deposits and soils, and the techniques used are thus those of surface mining. The total affected area over the project life will be 7000 ha within the mining concession, although at any single point in time the operation will cover only a 200 meter by 200 meter area that moves slowly across the project area from day to day. Ilmenite will be separated from the sand at a central separation plant and power plant. The power plant will generate surplus power that will flow back into the local grid. The project will remove the existing forest cover and reforest it in its path through a reclamation project that involves the replanting of eucalyptus. The technical viability of the reclamation component of the project

has been established through a forest rehabilitation project conducted by MinComp over the past 5 years.¹

Two general project options have been elaborated by the proponent. Both of these projects have similar mine development plans, but the associated infrastructure in each case is quite different.

Option A – Stand-Alone Project. Railroad and New Dedicated Port. In this scenario, the ilmenite is shipped to a tidewater site by a 10 km railway system built specifically for this project. The tidewater site would require construction of a small new dedicated port and breakwater for the export of the ilmenite. Under this scenario, the company will bear 75% of the costs of the project.

Option B – Integrated Project. Upgraded Road to Expanded Port at Fort Brot. In this scenario, ilmenite is shipped via an upgraded road to an expanded port facility at Fort Brot. The road upgrade would create a year round road capable of handling large volume industrial traffic. The port expansion would involve construction of a multi-purpose port that would handle the ilmenite freighters, as well as cargo handling facilities for other goods. The expanded port will also accommodate one cruise ship berth. Under this scenario, the company will bear 25% of the total project costs.

The associated impacts of these two scenarios differ considerably. In the case of the stand alone project (Option A), impacts of the project are largely contained to the mining concession site and adjacent area. In the integrated project, a number of associated impacts occur. Key direct additional benefits are: (i) improved access to Deli National Park; (ii) improved agricultural benefits from approximately 30,000 ha of marginal cropland. One additional element, however, requires that the fish landing site currently in Fort Brot harbour be moved. The proposed site is just north of Fort Brot, and construction of this landing site will involve infilling a wetland that is adjacent to some of the prime tourist beach areas. Another concern is that increased shipping traffic may pose a hazard to the Deli Archipelago.

The direction of mining also differs between the proposals because of the location of transportation infrastructure. In Option A, mining will commence in the north and proceed southward. In Option B, mining will commence in the south and proceed northward.

Project Revenue/Cost Sharing Assumptions

The project cost and revenue sharing arrangements between the government and MinComp are consistent with those in the Memorandum of Understanding of 1997. Under this MOU, the following terms are relevant to this analysis:

- MinComp will operate the project, incurring all operational costs (including reclamation).
- MinComp will finance 75% of project capital costs in the event a stand-alone project (Option A) proceeds; it will finance 25% of project capital costs in the event that an integrated project (Option B) proceeds.
- the Government of Mañanaland will receive a gross royalty on all ilmenite sales equal to 20% of the value received f.o.b. a tidewater site.

¹ Since 1995 the company has been spending some \$4 million a year on this project on a test area within the mining concession. The World Environment Union and the Ministry of Forests, Agriculture and Fisheries have been monitoring this project as described in the EIA. At time of writing, rehabilitation has been successful on 80% of the land after the first attempt and 95% after the second attempt.

- all surplus electricity generated by the power plant will be the property of the Government and will be delivered directly to the national power grid.

Analytical Assumptions

In conducting the cost benefit analyses (CBA), government direction was sought on the values of various parameters. Based on such consultations, the following assumptions were agreed to:

- discount rate. All public sector investments are compared at a real discount rate of 10%. This is therefore the base case taken for this analysis. We also, however, provide results at discount rates of 5% and 15%.
- donor resources. Donor resources are treated equivalently to other government (domestic) resources on the assumption that they are fungible and would need to be directed to the best available opportunities. Many of these will have payment terms attached and the government is exercising due prudence to ensure that cash flows can indeed meet any such repayment requirements.
- shadow wage rate (SWR). Because of the high level of unemployment in Deli, it was suggested that unskilled labour should be valued at 50% of the market rate for the purpose of social CBA. Because it was believed that these levels of unemployment are not likely to be permanent (and would likely drop in the long term in the event that the project proceeded), this SWR should be applied only during the investment period.
- welfare weights. It was requested that the project analysis treat all costs and benefits to Mañanaland equivalently. The only separation that should be reflected is that between MinComp and Mañanaland (i.e., MinComp equity investments and net profits are treated as external to this project).

In addition, it was agreed that the project would be evaluated over a 28 year time horizon corresponding to the anticipated 3 year investment period followed by a 25 year mine production life.

In using these assumptions, we also note that the following simplifying assumptions were made in the process:

- no premiums were assigned to foreign exchange earnings; and,
- no analysis was conducted of the reduction in local “unmet electricity demand” that would arise as a consequence of this project. The analysis took a national figure for the marginal cost of additional electricity supply as a basis for valuing the power generated by this project.

Both of these simplifying assumptions may cause a slight underestimate of project benefits.

Finally, we note that the baseline scenario of “no project” assumes that neither Option A nor Option B proceeds. By definition the net present value (NPV) of the baseline scenario is taken as zero, and all costs and benefits in the two options under consideration are taken as incremental to this baseline. The NPV of Options A and B can thus be compared directly as they are two mutually exclusive projects. The economically optimal project will thus be the one with the highest NPV (or, if both Options have negative NPVs, the optimal project would be the baseline scenario of “do nothing.”)

Table 2. Summary of Costs and Benefits from Project (US\$ 2000)		
	Option A	Option B
Project Revenue		
Ilmenite sales	\$25 million/yr	\$25 million/yr
Surplus power value	\$2.0 million/yr	\$2.0 million/yr
Capital Costs		
Construction capital costs	\$55 million includes \$50 million for mine capital and \$5 million for compensation and mitigation contingency related to environmental impacts	\$55 million includes \$50 million for mine capital and \$5 million for compensation and mitigation contingency related to environmental impacts
Separation and power plant	\$30 million	\$30 million
Railway construction	\$10 million	
Dedicated port & breakwater	\$25 million	
80km Road upgrade		\$88 million
Fort Brot port expansion		\$74 million
New fish landing site		\$3 million
Operating Costs		
Reclamation and reforestation	\$5 million/yr	\$5 million/yr
Mine operation	\$3.5 million/yr	\$3.5 million/yr
Road and other maintenance	\$3 million/yr	
Other Impacts		
Net forestry impacts		nil
Net fishery impacts		nil
Tourism benefits		\$5.85 million/yr Benefit
Reduced malaria costs		\$1.5 million/yr Benefit
Value-added processing		\$7.5 million/yr Benefit
Expected value of losses from shipping accident		\$100 (one hundred dollars)/yr Cost
Wetland degradation		\$15,730/yr Cost

Discussion of Project Revenues and Costs

Table 2 provides a summary of the main cost and revenue items for the project.

Project Revenues. Revenues under the two options are the same, and they correspond to an expected production of 350,000 tonnes of ilmenite annually. Real prices for this mineral are expected to remain stable over the period at today's price of US\$71.50/tonne. Power generation is expected to yield surplus power over the year of about 40 million kWh. Valued at a marginal cost of power supply to the government of 5¢/kWh, this has an imputed value of \$2 million annually. This is also the likely revenue that can be expected as the current average tariff for power is also at this level.

The total annual direct project revenues (benefits) from either of these two options is thus forecast to be \$27 million. Of this, the share to government under the revenue sharing agreement would be \$7 million.

Project Capital Costs. The total project capital costs under the two options is as follows:

Option A - \$120 million (Government share: \$30 million)

Option B - \$250 million (Government share: \$187.5 million)

The two options have the same common site constructions costs (\$55 million) and power plant costs (\$30 million). All of these required skilled or semi-skilled labour for construction. We note that these costs include a \$5 million environmental contingency that is consistent with the EIA findings that there may be some temporary impacts from initial site preparation. These funds are made available for the following: (i) primarily to provide mitigative expenditures (e.g., construction of bridges across ecologically sensitive streams); and, (ii) to pay damage compensation where mitigation was unsuccessful (e.g., for lost fishery catch, or damage to locally important forest stands).

Project Operating Costs. The total project operating costs under the two options is as follows:

Option A - \$8.5 million/yr (paid by company)

Option B - \$11.5 million/yr (paid by company)

The major component of this is the \$4 million to be spent annually on reclamation. This involves reclaiming the land and planting eucalyptus, consistent with the demonstration projects currently underway. The target of this plan is to create a “no net loss” situation that, in effect, results in a standing forest that is of higher quality than the existing forest. The slightly higher quality compensates for the loss of forest services from a small area for a short period of time.

Other Impacts. Project Option B will generate an **additional \$14.8 million annually in net benefits** attributable to the following associated impacts.

Forestry services (nil). As noted above, direct impacts will initially be compensated through the contingency fund and are thus treated directly as a project cost. Local use surveys indicated that the primary service derived from the trees themselves was for fuelwood. Adequate substitutability exists within the concession area to permit continued fuelwood harvesting in those areas not affected by the mining operation. The replanting program ensures that the ongoing demand for fuelwood will not be impacted by this project. Consequently, no net losses or benefits are anticipated.

Fishery impacts (nil). The project does not directly affect fishery catch. It does, however, call for a relocation of an existing landing site. The facilities will be located just outside of Fort Brot, close to the tourist area. The project design permits some of the funds to be used for improving access between Fort Brot and the new landing site. Discussions with some local fishing groups showed that some fishers feared that fish prices might be negatively impacted because the landing site was further from the local market (Fort Brot). While this may be true, the new landing site is closer to the higher valued “tourist market” associated with the resort hotels and restaurants in the nearby beach areas. It is assumed that these two influences will offset each other and that fishery revenue will remain unchanged.

Tourism services benefits (\$5.85 million/yr). Current tourism levels have remained at about 4000 people annually for the past 3 years. Extensive surveys were undertaken in the form of origin-destination studies, expenditure surveys, and a contingent

valuation survey to determine willingness to pay for forest ocelot viewing. Results of this analysis showed that one could expect a net increase of 18,000 tourists annually with an average length of stay of five nights. Average net values retained locally are \$50/night, suggesting a total value retained within the Fort Brot local industry of about \$250 a tourist. In addition, the CV survey showed that the expected willingness to pay for a half-day of ocelot viewing was \$75 a person; this is consistent with values derived elsewhere suggesting payments of \$50 to \$150 a person for viewing charismatic species such as mountain gorillas, chimpanzees, and rockhopper penguins. We therefore assign a net capturable tourism value of \$325 a person to these 18,000 visitors. We note that potential cruise ship “day” passengers are omitted from this.

Malaria reduction benefit (\$1.5 million/yr). Current malaria incidence in the coastal area is about 1000 cases a month. The typical impact is 2 weeks of lost productivity a case, and the sufferer incurs some expense for medication. A cost of illness analysis suggests that average impacts are \$125/case. The total benefit of malaria eradication (linked to draining and filling in the wetland where the fish landing site will be built) is thus \$1.5 million/yr.

Value added processing (\$7.5 million/yr). Revitalization of agricultural crops will provide a significant benefit to the region. Crops that are currently uneconomic because of high transportation costs or lack of markets will now become viable because of improved road infrastructure. Value-added processing of these commodities for export or domestic sale will further enhance these opportunities. The analysis suggests that some 30,000 ha will be affected with net gains of approximately \$250/ha/yr.

Accident risk (negligible). Risk to the marine and coastal habitat is of considerable concern within the region. A risk analysis of shipping activity was undertaken to determine the potential for the occurrence of a “system level threat” (e.g., substantial spill from grounding or accident). Parameters within the model reflected that the port would be used 40% of the time for industrial activities related to ilmenite export, 20% by tourism related services, and 40% by other cargo import and export. Local weather and current conditions were incorporated to determine spread of impacts. Ten million simulations of a typical day of activity were modelled through computer simulation, which were in turn sampled at random to provide likely accident risks. Within this framework, the maximum probability of an accident being generated was approximately 0.001% in any given year of port operation. The values at risk were taken to be tourist values and fishery catch (a total annual value of approximately \$10 million), resulting in an expected annual value loss of \$100. This amount is treated as negligible within this analysis.

Wetland services losses (negligible). The wetlands that are planned to be infilled currently provide only a nursery function to the local coastal system. Benefit transfer literature suggests that such systems have a value of \$143/ha/yr. The total size of this coastal lagoon is relatively small – 110 ha – and the potential service lost is thus valued at just under \$16,000 annually. This amount is negligible in the overall analysis.

Results of Economic Analysis

In addition to the cost benefit analysis, an economic impact model was used to show the direct employment and production impacts if the project options on the local economy

(Table 3). Because Deli Province is a very “open economy” – permitting free flow of labour and other inputs – such results should be regarded as “order-of-magnitude” impacts. They clearly show, however, that Option B will have a far greater impact locally than will Option A.

Of greater interest from the viewpoint of economic efficiency, however, we now turn to the results of the social CBA. Table 4 summarizes these results for the two options under consideration.

Table 3.
Other Economic Impacts on Deli Province

	Option A	Option B
Construction Employment (person-years)	3,300	36,800
GDP Impact (% Growth)	+3.6%	+14.8%

Table 4. Results of Social Cost Benefit Analysis

	Option A		Option B	
	MinComp	Mañanaland	MinComp	Mañanaland
Base Case Present Value at 10% Discount Rate				
Project Revenues	+ 123.99	+ 43.40	+ 123.99	+ 43.40
Project Capital Costs	– 67.82	– 22.61	– 47.10	– 141.30
- labour cost adjustment		nil		+ 30.90
Project Operating Costs	– 52.70	0.00	–71.30	0.00
Forestry Impacts		negl.		negl.
Fishery Impacts				negl.
Tourism Benefits				+ 36.27
Health Benefits				+ 9.30
Value Added Processing Benefits				+46.50
Net Present Value - NPV (10%)	+ 3.47	+ 20.79	+ 5.60	+25.06
Other Performance Indicators				
NPV (5%)	+ 55.54	+ 55.23	+ 44.53	+126.70
NPV (15%)	– 17.06	+ 6.02	– 9.95	– 16.20
IRR	10.6%	19.1%	11.3%	12.5%

Conclusion

The cost benefit results show that, from the perspective of Mañanaland, either of the two options would be preferred to the status quo (no project). Of the two options, **Option B – the full integrated project – provides the greatest net social benefit using the Government’s current public investment guidelines.**