Sustainable development and the environment: lessons from the St Lucia Environmental Impact Assessment

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The environmental impact assessment (EIA) on the effects of the proposed mining on the Eastern Shores of Lake St Lucia was arguably the largest and most transparent yet undertaken on the African continent. It assessed the consequences of proposed mining in coastal dune systems in northern KwaZulu-Natal, in an area regarded as very important for conservation. Public opposition to the mining, and participation in the EIA, reached unprecedented levels. The EIA took place during a time of profound political change in South Africa, and in an environment with differing cultures, making the assessment of impacts and their relevance to different groups exacting. Our ability to make clear and meaningful recommendations with regard to the adoption of future options was hampered by the lack of a strategic regional planning framework, by changing political factors, and by the lack of rigorous scientific models on which to base the prediction of impacts. The material produced by the EIA was reviewed by a panel of eminent lay people, who in turn made a recommendation to the government of South Africa not to allow mining. Their recommendation represents an example of the application of the precautionary principle, and was made both because of the perceived value of the area ('the sense of the place') and because of the inability to make exact predictions of the magnitude of expected impacts and the degree to which they could be mitigated.

There are several important lessons that can and should be learnt from this exercise. These relate to the importance of wide scoping and early identification of the important issues; the way in which EIAs of this nature have to deal with uncertainties and ignorance; the role of 'intangibles'; and the need for new paradigms in relation to the accepted models of the management of conservation areas in developing regions characterised by overpopulation and abject poverty.

The environmental impact assessment on the effects of the proposed mining on the Eastern Shores of Lake St Lucia has driven the environmental debate to new heights in South Africa.[1-5] Seen in a global context, the debate followed trends elsewhere. Environmental awareness and concern throughout the world have resulted in the rapid evolution of policy thinking relating to economic development. The view that development and growth need to be limited soon, to avert impending resource shortage and environmental disaster (the limit to growth paradigm), is being replaced by policies aimed at harmonising economic development and environmental protection goals, in the recognition of their interdependence. This latter approach has in turn been replaced by one crystallised at the UNCED summit in Rio de Janeiro in 1992 and in Agenda 21, which focuses on integrated policies and strategies to exploit the '... complementarity between poverty reduction, economic efficiency, and sound environmental management' — in support of the goal of environmentally sustainable development with social equity.[6]

In respect of development projects, and indeed any initiative with the potential for environmental harm, this line of policy thinking tends to be associated with the precautionary principle[7] and with environmental impact assessments. The precautionary principle holds that projects should not proceed unless they can be shown not to cause environmental harm. Environmental impact assessment is the process designed to support decisions regarding development proposals, and executed so as to provide credible and legitimate assessments of their environmental, economic, and social costs and benefits.

These principles are rapidly pervading both the developed and underdeveloped world, driven by international agreements, government statutes, policies of influential international agencies such as the World Bank, by environmental interest groups, citizenry, and by the strategic interests of firms which trade nationally and internationally. Africa offers special challenges to those implementing integrated development strategies and projects. It is the continent with the highest rate of growth in human population in the world, and in which poverty is growing fastest.

The EIA that evaluated the likely impacts and benefits from mining or other forms of land use on the Eastern Shores of Lake St Lucia is a landmark in the development of the environmental debate in South Africa. It was an expensive and time-consuming exercise, and as such it is essential that the lessons from the project are documented, absorbed by the wider community, and built upon.

In this paper, we describe the design, execution and outcomes of the St Lucia EIA, and consider the lessons that arise from this. The broader policy issues are considered from the point of examining the role of EIAs within a developing framework of integrated environmental management (IEM),[8] and strategic environmental assessments.

The environmental impact assessment for the Eastern Shores of Lake St Lucia

The EIA for the Eastern Shores of Lake St Lucia examined two forms of land use. The first was for the development of the Eastern Shores as an ecotourism destination, based on the area's outstanding scenic attractions and wildlife (the ecotourism option). The second was to mine a portion of the dune cordon between the lake and the sea for valuable heavy minerals, followed by rehabilitation, while at the same time allowing tourism development and conservation to proceed insofar as this could be done in conjunction with mining (the mining option).

Lake St Lucia (Fig. 1) is some 40 km long and flows into the sea at its southern end through a channel of about 20 km, The Narrows. The area considered for mining was on the Eastern Shores of Lake St Lucia, on a narrow strip of land between the lake and the sea.

The St Lucia environment is of special significance for a

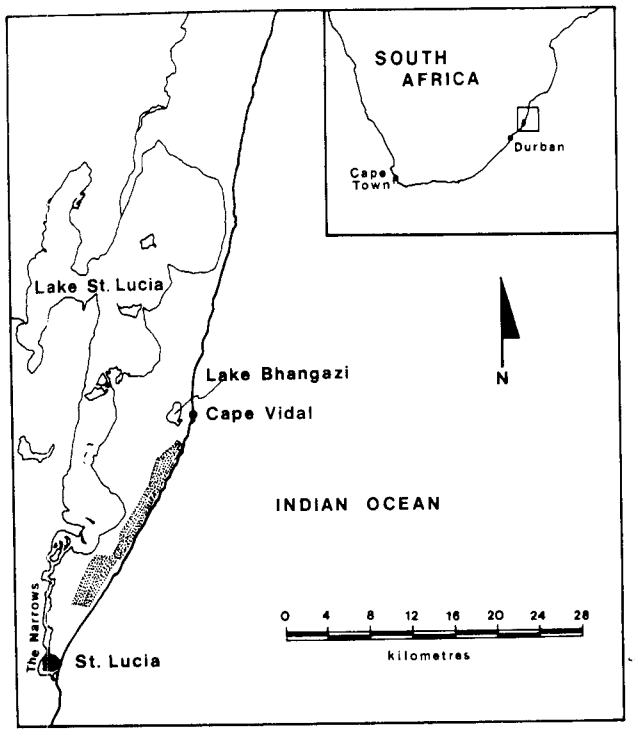

Fig. 1. The Eastern Shores of Lake St Lucia are situated in the north of KwaZulu-Natal, South Africa. The shaded area shows the extent of the mining prospecting lease area, within which mining was proposed.

number of reasons. Because it includes a variety of habitats — marine, freshwater, and terrestrial — and is located in a biogeographic transition zone, levels of biodiversity are unusually high. The varied landscape attracts people for recreation, and a rich cultural priority is associated with the place. The area includes also the oldest statutory conservation area on the African continent.

The issues raised by the proposals were complex, and involved strong arguments for both alternatives. The assessment required an approach which would integrate a considerable amount of information to address key issues of concern. The case was highly publicised, and as such it became the first EIA in Africa which involved a significant level of public participation. It was the first occasion on which a comprehensive implementation of the draft policy for IEM was followed in South Africa. It was also necessary to assess impacts and perceptions across differing cultural boundaries within a developing economy.

The case is of wider relevance for several reasons. First, the environmental, economic, and socio-political circumstances of South Africa make the country a microcosm of the world in many ways. The province of KwaZulu-Natal has a relatively rapidly growing population (about 2.7% per annum), with rising levels of poverty. Unemployment is high (27%), and in rural districts, many families receive no cash income. The disparity in terms of income, education, and other measures of quality of life in society are great. Members of wealthy society in South Africa, mostly white, evidently hold environmental values strongly. The poor have other priorities.

The approach adopted for the EIA at St Lucia was designed to fit international norms, but to accord with the then conceptual policy of IEM for South Africa. The approach involved four sometimes parallel phases:

(a) the assembly of an environmental impact report, which was to integrate evaluations of the environmental, economic, and social costs and benefits in such a way as to facilitate a policy decision which balanced costs and benefits in totality;

(b) involvement of the broad public through representative institutions (Table 1) and, in the penultimate stages, direct participation, in determining the land-use alternatives for the area, defining the elements of the assessment, in evaluating the scope and quality of the assessments, and in expressing their views, beliefs, values and preferences on the matter;

(c) a recommendation for a preferred land use by a panel of eminent lay people (the Review Panel), chosen in consultation with interested and affected parties (I&APs); and

(d) a decision by the government of South Africa.

The process began when an initial environmental impact report was produced, leading to a public outcry and a directive from the South African cabinet for the necessary impact assessment to be carried out (Fig. 2). This was done by initially scoping to establish the so-called key issues with I&APs, and then conducting additional scientific studies to address these. It was at this stage that the CSIR was asked to take over the execution of the project, and when our involvement with the EIA began.

The impacts were assessed by combining the information produced in 24 specialist studies to address the 11 key issues of concern (these included ecological, social, economic and intrinsic issues). Following this, an environmental impact report was drawn up, which integrated and refined the assessments further, and made recommendations for mitigation. Certain non-scientific methodological conventions were applied to provide aggregate assessments of impacts (Table 2). The report was subjected to public review, which resulted in substantial comment. Further scientific studies to address new or disputed issues were then conducted, and a reassessment of the impacts and recommendations was made. This process, from the initial impact report to the publication of the final revisions, took place over four years. Finally, the Review Panel made use of the substantial documentation that arose from the process, together with inputs from a two-week session of public hearings, to make a recommendation to government.

Two important points can be made with regard to the above process. First, there was an evolution of ideas around the consequences of the proposed developments as new information became available. This was an inevitable consequence of the process, involving as it did several iterations between the specialists, the compilers of the impact report, the development proponents, and the I&APs. Secondly, as the predictions made by individual specialists were used to address the key issues of concern, and to make recommendations, the impact assessment developed 'emergent properties'. By combining individual assessments, a clearer picture of the overall consequences of the developments, which were not identified earlier on, was developed.

The process was not designed as one which would yield a single decision variable. For example, an economic methodology such as cost-benefit analysis, seeking to monetise all costs and benefits, was not applied (though cost-benefit analysis was used in the economic assessment). Rather, the final integrated evaluation was left to the judgement of the Review Panel, supported by a transparent process of providing relevant factual and authoritative assessments determined to be necessary for the decision.

The process was also designed to be inclusive of all interested parties, and to be democratic. This ought to have been reflected in the identification of I&APs (see Table 1). However, government bodies among the I&APs tended to lack legitimacy, a consequence of the political dispensation of the time in South Africa. Local communities were weakly represented in this list.

Table 1. List of lead Interested and Affected Parties (I&APs) in the St Lucia Environmental Impact Assessment.

Lead interested and affected parties	Status	Main area of interest	Scale of stakeholder interest
Chamber of Mines	NGO	Interests of the mining industry	National
Department of Environment Affairs	Central government	Responsible for environmental policy	National
Department of Mineral and Energy Affairs	Central government	Administering mining legislation and regulations	National
Department of Water Affairs and Forestry	Central government	Management of plantations on Eastern Shores	National
KwaZulu Bureau of Natural Resources	Provincial government	Regional conservation in adjacent areas	Regional
Natal Parks Board	Provincial government (proponent)	Responsible for management of Eastern Shores	Regional
National Union of Mineworkers	Trade union	Workers rights and interests	National to local
Natal Provincial Administration	Provincial government	Responsible for regional policy development	Regional
Pinechem (Pty) Ltd	Business company	Presents views of regional commerce and industry to government	Local
RDAC Region E	Statutory organisation to advise on regional development	Local business interests on Eastern Shores	Regional
Richards Bay Minerals	Mining company (proponent)	Mining company with rights on Eastern Shores	International National to local
St Lucia Town Board	Local government	Local town management	Local
Wildlife Society of Southern Africa	NGO	Non-government organization with conservation interests	National
Zululand Environmental Alliance	NGO	Non-government organization with conservation interests	Regional

Only the St Lucia Town Board (representing mainly the white people of the town of St Lucia) spoke for a local community.

Also important was the fact that, as a matter of policy, land uses other than the two considered in the EIA were excluded. Although claims for redress were known to be emanating from communities evicted from the Eastern Shores (see later), this factor was not taken into account. NGOs and others also tended, predominantly, to reflect the view of the educated, wealthy segments of South African society. Marginalised communities were drawn closer to the process by a special participatory programme in the latter stages of the EIA, and during the final public hearings.

The EIA was initiated by a cabinet instruction on 13 September 1989, following the publication of an initial impact assessment by the proponent of the mining option (Richards Bay Minerals, RBM), and a public outcry. Specialist reports[9] were circulated to leading I&APs during August and September 1991, and comments[10] were addressed in the Specialist Reports prior to publication. An environmental impact report[11–13] was released for public review on 18 March 1993, for 14 weeks. A response report was published in August 1993.[14,15] The Review Panel held public hearings during November 1993 and released their recommendation[16] in December 1993. The final decision by the government, in May 1996, was that no mining should be allowed.

Impacts on issues of environmental concern

Issues of concern were grouped into three broad categories: environmental, economic and intrinsic. For each of the issues, our brief was to assess impacts and benefits, and to provide an assessment of whether or not 'irreparable damage' would result. Environmental concerns were focused on whether or not the ecosystem of the Eastern Shores would be affected by mining.

The St Lucia area is not a pristine environment, having been occupied by communities of Zulu people for centuries, who practised shifting cultivation and burnt the vegetation annually to favour grazing for their livestock. These people were evicted between 1950 and 1970. At this time, afforestation with exotic *Pinus* species proceeded under state control, until 5244 ha had been afforested. Of this, 904 ha fell within the 1436 ha of the proposed mine path. By 1990, government authorities had agreed that these plantations should be cleared over the next 20 years, and the land handed over to the Natal Parks Board (NPB). At this stage, the entire area would be proclaimed a statutory conservation reserve.

Thus, despite a history of statutory conservation measures dating from 1897 during British administration, the area and its ecosystems had been disturbed to a greater or lesser degree. Environmental impacts needed to be evaluated against this datum, as modified by human action. Of principal concern here were (a) potential impacts on the hydrological regime of the dune cordon and hence on the stability of the dune system and on wetlands and Lake St Lucia to the west, and (b) effects on biodiversity (Table 3).

Dredge mining would involve the seepage of an average of 50 000 m^3 of water per day from the mine pond, the equivalent of 338 times the average annual rainfall on the 4.5-ha surface of the pond. Such a large flow of water through the dune system seemed to have obvious potential for severe environmental impact. Nevertheless, because (a) the body of the dune consists of relatively uniform, highly permeable sand, (b) the local water table is elevated only a few metres above sea level, (c) 70% or more of the water percolating through the dunes flows to the sea, and (d) the very large volume of sand relative to the volume of water involved in mining, the impact of mining on water tables, wetland areas and levels, flow to the lake, and lake environments

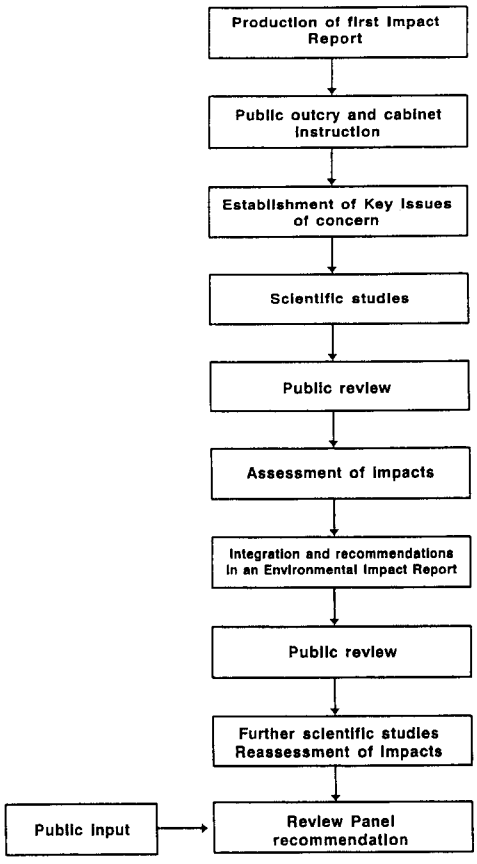

Fig. 2. The EIA process as designed for the appraisal of impacts of land use on the Eastern Shores of Lake St Lucia.

was predicted to be moderate at most, with very low or no residual effect. Water quality in the wetlands and lake would similarly be little affected, owing to the filtering of the water during its slow passage through the dune sand, and the low volume delivered to the lake relative to its own volume, despite some possible local freshening of the saline lake waters.

In terms of biodiversity, mining was predicted to have moderately negative effects in the long term within the mine path. Impacts on biodiversity in adjoining habitats, including the sea, the estuary and the lake, would be low or negligible because infrastructural developments could be limited and carefully designed and sited.

Rehabilitation was judged likely to restore ecological processes of succession, analogous to the recovery of forest and grassland observed after depopulation of the dune systems at Eastern Shores because of: (a) the relatively rapid, generally observed and documented succession on dunes on the east coast of southern Africa and its analogous ecosystems elsewhere in the world; (b) relatively well documented, successful restoration of ecological processes after 14 years on dunes rehabilitated by RBM at its dredge-mining operations at Richards Bay, 80 km south of St Lucia; and (c) relatively successful rehabilitation of dredge-mined dunes in similar environments on the east coast of Australia.

These findings regarding the hydrological regime and biodiversity were severely criticised by I&APs and other commentators. The Monitoring Mission appointed in terms of the Ramsar Convention[17] to investigate the implications of mining with regard to the status of the Ramsar site at St Lucia, added to the criticism.

The essential arguments offered by critics were as follows:

(a) the body of the dune cordon could not be regarded as homogeneously permeable because of stratification within the dune sands; mining would destroy this stratification and thus irreversibly alter the hydrological regime, rendering hydrological predictions uncertain, and eliminating habitat diversity, hence permanently reducing biodiversity in the St Lucia system; and

(b) rehabilitation of mined dunes elsewhere had not yet led to fully restored, functioning ecosystems: in any event, the composition of the ecosystems at St Lucia differed from those rehabilitated elsewhere; therefore, there were no technologies for rehabilitating and restoring ecosystems at St Lucia.

Consequently, whether St Lucia ecosystems, and hence biodiversity, would recover after mining, or not, was in the critics' view a major uncertainty.

In response to these criticisms we initiated a major re-examination of the geological information on the dune cordon, conducted by an independent geologist but in collaboration with both RBM and the NPB. The goal was to find evidence of microstratification within the dunes which would affect hydrological and soil–water regimes. The study involved re-examination of

Table 2. Standard set of conventions to assess impacts and benefits: impacts, both negative and positive, related to both land-use options, and were used by specialists in describing such impacts or benefits in the EIA (after Coastal and Environmental Services[9]).

Spatial scales	Time scales	Significance rating	Degree of certainty
International	**Short term** (0–5 years)	**Very high** Of the highest order possible. No possible mitigation for adverse impacts at spatial or time scale for which predicted, or no real alternative to achieving benefits exists.	**Definite** More than 90% sure of a particular fact. Substantial supportive data to verify assessment.
National	**Medium term** (6–30 years)	**High** Impacts of substantial order. Mitigation feasible but difficult for adverse impacts, **or** other means of achieving benefits would be difficult.	**Probable** Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Region KwaZulu districts: Enseleni, part of Hlabisa, Ngwavuma, Ongoye, Ubombo. Natal districts: Hlabisa (in part), Lower Umfolozi, Mtunzini.	**Long term** (more than 30 years)	**Moderate** Impact real but not substantial. Mitigation feasible for adverse impacts, **or** other means of achieving same benefit will be about equal in time, cost and effort.	**Possible** Only over 40% sure of a particular fact or of the likelihood of an impact occurring.
Sub-region		**Low** Impacts of low order with little effect. Mitigation easily achieved for adverse impacts **or** easier alternative means exist for achieving same benefit.	**Unsure** Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Eastern Shores area (12 308 ha)		**Very low** Impacts negligible. No mitigation needed for adverse impacts, **or** better alternative means exist to achieve benefit.	
Prospecting lease area (3 419 ha)		**No effect** No impact at all.	
Proposed mine path (1 437 ha)			

Table 3. Major environmental impacts associated with two proposed land-use options on the Eastern Shores of Lake St Lucia. Terminology follows Table 2.

Environmental factor	Mining option, with ecotourism development where feasible	Ecotourism option (no mining and full ecotourism development).
Terrestrial vegetation	**Very high** negative impact in the mine path in the short term, but with mitigation (a programme of rehabilitation), **low** to **very low** in the long term. A total of 7.5% of remaining natural vegetation on the Eastern Shores would be affected by mining. A localised negative impact at tourism development nodes.	Localised negative impacts at tourism development nodes.
Terrestrial animals	**Moderate** loss of numbers of some species such as red duiker, gaboon adder, Samango monkey and dwarf chameleon from mine path in the medium term.	**Low** positive impacts, through re-introductions of game.
Topography	**High** to **very high** impacts on topography in the long term. While major topographic features could be recreated, they would be displaced by about 500 to 1 000 m. Changes to topography are expected to have **no effect** on ecosystem function.	**No effects**
Soils	**High** decrease in soil nutrient status in the mine path in the medium term. Mitigation in the form of rehabilitation would probably lead to a return of soil nutrient levels in the long term.	**No effects**
Wetlands	Some **low** or **very low** negative impacts due to mining in the medium term, on the Eastern Shores. Where water from the mine pond would impact groundwater levels, toe-drains or pumping from deep boreholes would easily rectify these impacts. **Low** negative impacts associated with ecotourism developments in the long term, on the Eastern Shores.	Some **low** negative impacts associated with ecotourism developments in the long term on the Eastern Shores.
Biodiversity	**Very high** reduction in biodiversity in the mine path in the short term, reducing to **moderate** or **low** in the long term. Mitigation in the form of rehabilitation is possible; rescue plans for rare species could be implemented.	**Low** to **moderate** positive impacts through re-introductions, and rehabilitation of pine plantations.

data obtained previously, evaluation of the limitation of data-gathering techniques (geological drilling), and the drilling of a number of new sites, each selected as being most likely to reveal ecologically and hydrologically significant stratification. When this work was completed, comprehensive data were available from 66 borehole sites, so that the dune cordon was by that stage one of the best-explored coastal dune systems in the world.

No evidence could be found to support the views expressed by critics. Most criticism was based on arguments that the sampling technique destroyed or masked evidence of microstratification (a contention refuted by close examination of intact drilled cores), on data from sites outside of and not germane to the mine path, and on unsubstantiable inference from putatively observed vegetation patterns.

Little further could be done in regard to the questions of uncertainty in rehabilitation after mining short of initiating an experimental programme *in situ*. Information submitted in public commentary corroborated and extended the information, indicating that the rehabilitated ecosystems on the dunes at Richards Bay were on a recovery path which would lead to fully functioning ecosystems with high biodiversity. The conclusions in the EIR regarding environmental impacts as summarised in Table 3 stood unmodified by this stage.

The ecotourism option was predicted to have localised, moderately negative influences on vegetation at development nodes in the long term, but no other significant environmental impact.

Impacts on issues of economic concern

A key assumption in the economic evaluation was that mining and ecotourism development could proceed jointly, even if the ecotourism development would in part be delayed by the mine plan. A second was that any positive or negative economic impact of ecotourism development at the Eastern Shores would not be felt incrementally at regional or national levels, since ecotourists could switch to other destinations in the region or the country. This was assumed not to be the case for mining, as no known alternative ore bodies existed.

The ecotourism development plan as originally proposed by the NPB was judged unattainable. Instead, we used a financially and logistically feasible plan, providing for a 5% growth rate per annum within the Eastern Shores, for estimating future revenues from ecotourism. Even this modified plan would result in very high visitor densities, higher than is current in analogous well-developed wildlife reserves in southern Africa.

Obviously, the most beneficial option in economic terms was that where mining would proceed in conjunction with ecotourism development (Table 4). Beneficial effects would be felt locally, regionally and nationally, although the distribution of economic benefits was difficult to estimate. Benefits would be experienced in contributions to fiscal income (some of which would return to the region), in employment, in social contributions to local communities via education, health, and enterprise development programmes maintained by RBM and, potentially, NPB. Cost-benefit analysis of the mining proposal alone indicated a clear net benefit to the national economy.

These findings were severely criticised by I&APs on several grounds.

First, critics maintained that the ecotourism resource at St Lucia could not be assumed to be substitutable. People who would otherwise have been drawn to St Lucia on vacation by its unique attractions would be turned away by mining (not substantiated by opinion surveys), and would not visit nature reserves or wildlife parks elsewhere in the region or country instead. International tourists who would otherwise have visited South Africa would visit elsewhere in the world, they believed. St Lucia was the key to regional ecotourism development, and the region was a

Table 4. Major economic impacts associated with two proposed land-use options on the Eastern Shores of Lake St Lucia. Discounted values calculated at 8% per annum.

Economic indicator	Mining option, with ecotourism development where feasible	Ecotourism option (no mining and full ecotourism development)
Aggregate discounted revenue	R460 million to RBM for the life of the mine. R196 million to NPB for future ecotourism activities feasible in conjunction with mining	R265.7 million to NPB for future ecotourism activities
Discounted net present value (NPV)	R153.5 million for the life of the mine	NPV values are zero as NPB is a non-profit organisation.
Direct jobs	300 temporary jobs during commissioning phase of mine; 313 life-time jobs for the life of the mine. Between 212 and 392 life-time jobs in ecotourism feasible in conjunction with mining.	Between 212 and 392 life-time jobs from ecotourism
Indirect jobs	Between 1275 and 4675 life-time jobs indirectly through multiplier effects associated with the proposed mine.	
Net incremental tax revenues, discounted	R157.1 million in tax would be paid by RBM during the life of the mine	None
Net incremental foreign exchange earnings, discounted	R606 million in foreign exchange earnings gained during life of the mine	At a national scale foreign exchange earnings from ecotourism would be unaffected.
Social responsibility programmes	R8 million per year would be invested by RBM	Expenditure by the NPB on social responsibility programmes is not known. Between R100 000 and R200 000 per year is gained by local people through access to natural resources.

key to the South African ecotourism industry.

These criticisms did not, in our opinion, agree with common sense. Our findings regarding economic assessments were therefore not modified.

Another point of criticism was that the economic assessments did not take proper account of the social and environmental costs and benefits of the land-use proposals; technically, the total economic value[18] of each alternative had not been established. However, we had judged this approach to be infeasible, and that it would not provide valid estimates of non-use values because of the special political and social circumstances prevailing in South Africa and the technical and methodological difficulties which would thus prevent a total economic evaluation. Instead, the overall evaluation would need to be achieved through the judgement of the Review Panel.

Impacts on issues of indirect or intrinsic concern

The principal concern here was that of impacts on people's sense of place and other intrinsic values.[18,19] These proved the most difficult to evaluate (Table 5).

Very high or high negative impacts of mining on the visual quality of the environment were predicted for the short term, until rehabilitation restored a landscape which would appear natural to the passing visitor. Even so, this disturbance would not be seen for much of the 17 years of mining from most places within the area, due to screening by dune ridges. The mining operation would not be seen from the beaches at all, and little would be seen from offshore — most visitors to St Lucia at the time came for the seaside attractions.

Neither land use would be significantly noisy, except very locally. Vehicular traffic would be little affected by mining, since the ore was proposed to be transported by pipeline. Vehicular density would increase significantly with the ecotourism option, and this with increased visitor density was considered likely to impact negatively on visitors' perceptions of St Lucia as a desirable location.

Predictions of the effect of mining on people's sense of St Lucia as a place, overall, were judged very uncertain, and could be moderate negative or low positive in the long term at one extreme, if mining as a land use were chosen as an obviously beneficial option, and if the process of decision making was seen to be democratic. On the other hand, impacts could be very highly negative in the short and medium term, and perhaps low negative in the long term, if the choice was perceived as a bad decision.

The predictions of the consequences of the ecotourism option were equally unsure, and ranged from very highly positive in the short to long term, to moderately positive or negative in the medium to long term.

The recommendations of the Review Panel

Despite intense public criticism of the environmental impact reports, the Review Panel found the EIA to be '... sufficient to enable them to fulfil their terms of reference and reach a conclusion', in spite of certain criticisms they had of the process that was followed. They found the EIR to be 'objective and highly professional', 'thorough' and 'competent'.

The panel recommended against the proposal to mine, and in favour of an alternative, not as proposed by the NPB, which would involve statutory protection of the area in a larger national park together with appropriate non-consumptive development with a focus on ecotourism.

The conclusion was reached, first, by recognition of the Greater St Lucia area as a special and unique place. The panel perceived and emphasised the intrinsic value of this larger conservation area as a whole, with its marine, beach, lake, estuary, wetlands, dune and inland ecosystems, in terms of its biodiversity and other values. The second important factor, which grew in prominence as the EIA ran its course, was the sense of place associated with the Greater St Lucia area. A sense of place was found to prevail among a wide variety of commentators including representatives of communities who had lived there before.

Table 5. Major impacts of an indirect or intrinsic nature associated with two land-use options on the Eastern Shores of Lake St Lucia. Terminology follows Table 2.

Indirect and intrinsic value	Mining option, with ecotourism development where feasible	Nature conservation and tourism option (no mining and full ecotourism development)
The archaeological heritage of the Eastern Shores	**Very high** positive impact on an international scale through increased knowledge of Iron Age sites if archaeological material exposed by mining could be used for study.	**No effect**
The historical heritage of the Eastern Shores	**Very high** negative impact on some historical sites: destruction of Norwegian Mission Station and RAF outpost on Mount Tabor. Mitigation would entail dismantling and reconstruction of the structures after mining.	**No effect**
Visitors' perceptions of the quality of the environment in the St Lucia sub-region	**Moderate** negative impacts due to noise from the mining operation on the Eastern Shores in the medium term. Some noise from ecotourism nodes on the Eastern Shores.	Some noise from ecotourism nodes in the long term, on the Eastern Shores.
	Moderate negative impacts of noise from forestry clearing operations in the medium term, on the Eastern Shores.	**Moderate** negative impacts of noise from forestry clearing operations in the medium term, on the Eastern Shores.
	High negative impacts on tourism in the sub-region in the short term during the construction phases to establish the mine.	
	Low positive impacts on increased accessibility in the long term on the Eastern Shores.	
	High negative impacts on game viewing and noise levels, due to increases in visitor numbers in the long in term on the Eastern Shores.	**High** negative impacts on game viewing in the long term on the Eastern Shores, due to increases in visitor numbers.
Impacts on the visual quality of Eastern Shores landscapes	**Very high** negative visual impacts of mining in the medium term. These could be mitigated to some degree.	**Low** negative visual impacts of tourism development in the long term on the Eastern Shores, easily mitigated.
	Low negative visual impacts of tourism development in the long term on the Eastern Shores, easily mitigated.	**Moderate** negative impacts in medium term due to clearfelling of forestry plantations on the Eastern Shores.
	Moderate negative impacts in medium term due to clearfelling of forestry plantations on the Eastern Shores.	
Impacts on the sense of place	Unsure, but could be **very high** negative in the short term at national and even international scales, particularly among conservationists, decreasing with time. Could be mitigated by means of a pro-active awareness campaign.	Unsure, but could be **moderate** to **very high** positive in the medium to long term at a national scale, and seen as a major victory for conservation.

Most expressed concern that this sense of place would be violated if mining were to proceed. Because the Greater St Lucia area was so uniquely special, because the area proposed to be mined fell into this area, and despite it amounting to only 0.5% of the total area, the integrity of the larger area and people's concept of it should not be violated by mining.

The panel viewed the economic benefits estimated for the mining option with some scepticism. First, they did not consider that ecotourism and mining could proceed concurrently. Second, the fact that mining would commence only seven years hence introduced major uncertainties in their minds as to whether, when the time came, the operation would be economically as attractive as it appeared now, or feasible at all. These, with others, were reasons for them to discount the economic value of the proposal, and hence the opportunity cost of the decision not to mine. Because of the special value attributed to the Greater St Lucia area, the remaining scientific uncertainties concerning the potential impacts of mining on the hydrology of the dunes and on the wetlands and the lake, though relatively small, nonetheless in their view constituted too great a risk to contemplate mining. Finally, lack of knowledge of the biota and ecological processes at Eastern Shores and the technology for dune rehabilitation constituted a major uncertainty, which in turn influenced the uncertainty of the predicted effects on biodiversity.

Mining would constitute a 'leap in the dark' in disturbing a system of unique and special value. The panel's recommendation is certainly an outstanding example of the application of the precautionary principle[7] in environmental management. Nevertheless, it was also clear that the purpose of the panel was to find a way for the resources of the area to be employed to maximum benefit, with least environmental harm. Risks that the envisaged benefits of this option would not realise were addressed through recommendations regarding legislative and institutional arrangements, designed to satisfy stakeholders, including land claimants, and maximise the chance of economic success of the ecotourism development strategy.

The Review Panel's recommendation has already been criticised.[1] Nevertheless, there is an even likelihood that their findings could equally have been made by any other representative panel of reasonable people.

Proposals for environmentally sustainable development

Our brief was formally confined to the evaluation of the two proposed land-use options. Nevertheless, it was obvious that the issue could not be evaluated within such a narrow scope. First, the ethos of environmentally sustainable development (ESD) demands a holistic view of any development proposal, including the role and interests of all stakeholders. The majority of stakeholders, especially local communities, were marginalised in the original brief for the EIA. Communities who had been evicted from the land were among those with the most urgent claims for restitution of their property rights. Others, too, were important. For example, it emerged during the public review that a community of artisanal fisherfolk derived significant value (albeit technically illegal) through exploitation of the resources of the lake. Secondly, I&APs stressed the need for a decision on land use in the Greater St Lucia area within the framework of a (lacking) holistic regional plan, and directed, fundamentally, at an ESD approach to the region as a whole. Finally, concurrent constitutional and political developments in the country made it clear that the statutes, principles, and processes intended to deal with land rights would lead inevitably to restitution of rightful claims to the land in the Greater St Lucia area.

A decision on land use which did not address the land-rights issue, which did not provide a framework for the equitable distribution of benefits arising from the use of the land, which did not seek to maximise benefits while minimising environmental harm, and which did not adequately empower stakeholders to determine the direction of these things, could not be sustainable in the society envisaged for South Africa and the world in future. Consequently, and at the request of the Review Panel, the impact report incorporated proposals for ESD in the Greater St Lucia area.

Our recommendations were intended to facilitate an approach to development centred on the Eastern Shores and the subregion which would ensure lasting, incremental, progressive contributions to the satisfaction of needs and improvement of welfare among local communities, and would be applicable under either alternative. An important assumption was that the rights of local black communities to an equitable share in the benefits of the resources available would be recognised, with or without resolution of claims to the land.

We recommended that the parties representing local communities, local business, agricultural, and forestry interests, agencies of the state, and RBM (should mining proceed), should be engaged in the ongoing design, implementation, evaluation and review of a sustainable development process. The process for identifying the parties should be carefully facilitated to ensure fully representative participation. We called for a new body to be created for this purpose, the Greater St Lucia Development Forum. Its brief would be to create the climate, process, and institutions needed to ensure a lasting contribution to local welfare, through the most-beneficial use of the resources within the subregion. Specific recommendations were made for the procedures to establish the forum, for its funding, and the goals whereby its success could be assessed.

Since there was common cause that tourism development would be significant in long-term development, we recommended that a comprehensively integrated scheme should be devised, implemented, monitored and evaluated by the forum to ensure the maximum engagement of local people in such development. The scheme would include the design to maximise opportunities for local people, strategic marketing of tourism, preferential contracting for supply of produce, participation of artisanal industries in the sustained use of resources, and coherent education and training programmes.

Although the brief for the EIA was confined to the two land uses, it was obvious that the eventual land use was likely to be determined in part by the question of land ownership. We recommended that the principal parties (the state and the claimants to the land) should begin the process of negotiation to achieve early agreement on the land issue. The purpose would be to facilitate the process of early decision taking on the most beneficial development in the Greater St Lucia area.

Should ownership of all or part of the Eastern Shores revert to communities, or agreement be reached with that in view, the development options for the area would widen. Decisions on such options would rest with the communal owners. The communities would choose their own way of reaching these decisions, but would face influence and pressure from many sources, not least of these being the I&APs in the EIA. We recommend that communities that are awarded ownership of, or participation in, the resources of the Eastern Shores be supported in the process of examining and implementing the community-trust alternatives.

Conservation status of the area

Whether or not mining goes ahead on the Eastern Shores, the question of the conservation status of the proposed Greater St Lucia Wetland Park would remain. The concept of such a park has long been envisaged; in fact, one of the most important recommendations of the 1966 Kriel Commission was that a new and enlarged conservation area, centred on Lake St Lucia, should be managed by a 'single body with the necessary experience and executive powers'.[20] This recommendation was not implemented.

It was clear from the public response to the EIA that the land around Lake St Lucia is seen as a key complex of major conservation value, deserving of national park status. In view of this, we recommended proclamation of the area as a national park in terms of the National Parks Act (Act 57 of 1976), but to be managed by the Natal Parks Board. In the case of mining being allowed, the same recommendation would have applied, except that the Kingsa/Tojan lease areas would not be included initially, but only after mining had ceased.

In either event, however, we recommended that the entire conservation proposal be evaluated in terms of the principles of IEM, with full public participation. In this process, new models for implementing national park provisions to the advantage of local communities needed to be considered. The envisaged forum would naturally have played a role in this process.

The Review Panel, in its recommendations, recognised that the future of the area was closely linked to development in the region, and the urgency of the need to resolve land issues and to alleviate poverty. They formulated two central objectives to guide their recommendations:

(a) to ensure that the 'special place' which is the Greater St Lucia area would remain so; and

(b) to ensure that those who have historic connections with the area, those who live within the area, and those who were displaced from the area would have a significant role in the management and operation of the area; and would receive direct economic and other benefits therefrom.

They therefore recommended that a national heritage park, incorporating the area broadly defined as the Greater St Lucia area, should be established by Act of Parliament, later to become a world heritage site. The government of South Africa should support the development of such a park financially. The act should provide for the management of the park by a board

consisting of representatives of local communities, the public, private-sector conservation agencies operating within the area, and the private sector in general. Ecotourism should be developed in such a way that it ensures that the character of the area is not adversely affected thereby, while at the same time providing the maximum financial and other benefits to the local communities involved.

In this way, the panel sought to secure local, regional, national and international interests in the Greater St Lucia area.

Risk, uncertainty and ignorance in scientific prediction

The debate around the predicted effects of mining on the ecosystems of the Eastern Shores was marked by calls for proof that damage would not eventuate before allowing mining to proceed. Our terms of reference included the requirement that we identify any cases of potential 'irreparable damage'; this proved to be a particular source of contention with regard to the issue of proof, leading to the application of the precautionary principle. But can such cases be proven? The conventions adopted in this EIA[9] dealt with the problem of uncertainty around such proof by asking specialists to provide the degree of certainty that they attached to their predictions (Table 2). These conventions were severely criticised in comments on the EIR, and calls were made for a formal risk analysis to address the issue. A risk analysis was conducted, but this did not allay the concerns of many commentators.

With hindsight, such an analysis was doomed to fail, because it does not recognise that science will never be able to quantify accurately all risks associated with developments, and that certain outcomes may be indeterminate. It is important that decision-makers understand these differences. Wynne[21] provides a useful framework for discussing the 'degrees of certainty' that we sought to find. For each issue, the challenge is to show the risks (where the odds are known), uncertainties (where system parameters are known, but not the probabilities), ignorance (where we don't know what is not known) and indeterminacies (where outcomes are outside the parameters of the scientific prediction) in a way that will facilitate the later value judgement. Indeterminacies go beyond the realm of science; they include questions that relate to social values, land-use policy and management. Scientists should make these differences explicitly evident to the decision-taker, who will then exercise much more secure judgement.

Two examples from the St Lucia EIA illustrate these principles. In the first case, rehabilitation after mining raises questions about the likelihood of re-establishing the vegetation and biodiversity present on the site prior to mining. The probability of achieving successful revegetation (a cover of some sort of vegetation) is a risk that can be linked to known rainfall patterns and probabilities. Attempting to predict the type of vegetation that would establish itself represents an uncertainty, as the successional pathway that would lead to this vegetation is determined by chance events. Whether or not the biodiversity of the area could be re-established is a case of ignorance. In the words of Edward O. Wilson,[22] biologists are 'flying blind' when it comes to knowing the numbers of species (even to the nearest order of magnitude) in an ecosystem, let alone whether they can be re-established.

While expert opinion was that, with proper mitigatory action, the residual effect of mining in the long term would be moderate, there was no way of quantifying the likelihood of errors. Even if there was, the matter of indeterminacy remains. If science could predict that the re-establishment of biodiversity is possible, for example, what guarantees are there that the management programme to achieve this would be maintained, or that policies with regard to land use would not change?

Secondly, predictions from hydrological models were constantly attacked in comments. This was in spite of the cogent reasons for the predictions of low impacts (that is, the low-level water table in the dunes, with a subterranean divide landward of the mine path, determined by the documented stratigraphy; the absence of indurating clay horizons, because of the low content of clay-producing minerals in the rocks from which the coastal sediments and dunes were derived). Uncertainty existed because the scientific analysis of the effects of mining could not provide the customary estimates of experimental error and confidence intervals.

In terms of Wynne's framework, the ability of the planned supply scheme to deliver water to the mine could be seen as a risk, quantifiable by means of reference to historic rainfall and river-flow patterns. Whether or not water losses from the mine pond could be kept within acceptable limits was an uncertainty, as the permeability of the lower sands in the dunes was not known, although it was known that this parameter was important. By definition, issues of ignorance escape recognition, so examples are difficult to provide; however, important parameters may have been omitted from the model (commentators were particularly distrustful of descriptions of the geology).

Indeterminacies with regard to the hydrological predictions would arise from social factors, such as changes to water use regulations or the pricing of water. These could result in changes to the mining method, or could force the use of sealants in the mining pond. It is important to recognize that technical or scientific disciplines alone will not be able to predict effects of this nature, and that this should be explicitly stated in impact assessments. Commentators, especially the Natal Parks Board, asserted that the uncertainties regarding rehabilitation were unacceptably high, and they recommended that adequate research at St Lucia should precede any mining authorization. This illustrates that the non-scientific nature of the indeterminacies was not recognised.

Impact reports are often compiled from a number of independent 'specialist studies', where scientists make predictions of impacts based on their specialist knowledge of the subject, or on models that reduce the problem to manageable proportions. The job of collating these reports into an environmental impact report is usually left to one or more integrative writers. This task requires that a broader view of the situation is taken; it often moves the perspective to a position beyond the assumptions of scientific models. It will increasingly require the ability to recognise and present the elements of risk, uncertainty, ignorance and indeterminacy in such a way as to facilitate public debate and decision taking, if EIA is to improve its usefulness.

Applying economic methods

The St Lucia EIA was the first case in South Africa where an environmental policy instrument (IEM) has been used specifically to examine alternatives that would contribute to economic and social development on a regional scale. IEM, and environmentally sustainable development, requires the rational weighing of environmental, social, and economic factors — even if some of these factors are expressed in emotional rather than rational terms. The EIA was intended as far as possible to provide an objective basis for the assessment of the alternatives identified. We found severe limits to what could be expressed objectively in common terms.

The discipline of resource economics[18] offers the methods for placing a monetary value on environmental, social and intrinsic

values. These methods could not be used in this case, because of (a) the lack of economic information pertinent to the scale and content of the St Lucia problem, and (b) the absence of prior research to provide the insights needed to support resource-economic valuations. Also, certain of the valuation methods could not be applied in the circumstances prevailing in South Africa at the time. For example, methods such as contingent valuation,[18] which require interviews with a representative sample of members of the public, could not be applied effectively across a population so variable in educational levels, value systems, and political privilege. The economic studies were useful in contributing to the overall assessment, but not to providing an integrated evaluation. An attempt to reduce the weights of the alternatives to one or a few indices based on expert weighing of the impacts assessed was rejected, simply because the indices were too subject to differences of opinion among members of the expert panel.

Aside from technical obstacles, applying economic methods to such a case is questionable because many issues lie in the realm of ethics and values and cannot thus be accommodated. In this respect, the IEM procedure is right, being designed to accommodate political processes. Economics properly applied would improve the platform for the process, but the St Lucia situation is not unique — most project proposals in developing areas would be formulated on the basis of assessed financial feasibility (internal to the proposed project), but without the framework of more extensive economic information which may be taken for granted in the developed world.

Intangibles

Many South Africans value St Lucia for its intangible benefits, captured in the notion of 'the sense of place'. This was addressed in early studies of views expressed by holiday visitors, by interviews with Zulu people claiming rights to the land,[23] and in the last stages, by public representation. The salient fact to emerge was that there was a large, if unknown, constituency which strongly espoused the symbolic value attached to the place of St Lucia as they experienced it (as a rightful home, as the home of ancestors, as a place to experience nature, for its therapeutic value to brutalised youth, as a milestone in the environmental struggle), directly or vicariously, and claimed the right to determine the decision on land use, in favour of excluding mining.

The Review Panel placed significant weight on this fact, and indeed extended the scope of consideration to include the 'sense of place' of the whole of the so-called Greater St Lucia area, that is, they explicitly reckoned that the land-use proposals would affect the whole area, not just the Eastern Shores and its immediate environment. This view, coupled with the uncertainties over the predicted impacts, undoubtedly led the Review Panel to adopt a precautionary approach.

The role of public participation

We have seen that EIA must necessarily be a political process, underpinned perhaps by scientifically valid assessments, but nevertheless involving the participation of all stakeholders in setting the research agenda, and evaluating alternatives. This arises inevitably from the fact that ethical and moral values are at issue, and are not always amenable to economic or other rational measurement.

In the St Lucia EIA, public participation, though initially weak, later drove the agenda strongly, and will have contributed not just to a resolution of the St Lucia case, but also to the further development of policy in South Africa. Yet this participation was inadequate in that not all interest groups, especially local disadvantaged communities, participated effectively, or at all.

This inadequacy arose in the first place because of policy, which regarded the area as being available only for the purposes of the state. Later, this was amended through the recognition of the potential validity of land claims, and the need for a rural liaison programme, to inform and engage local black constituencies. Even then, some constituencies were not recognised, for example, the traditional fisherfolk deriving (technically illegal) benefits from the area. Current policies in South Africa are intended to ensure full participation in such cases in future. Whether this will be achieved will depend on (a) the capacity among local communities to participate, (b) the design and implementation of appropriate I&AP processes, and (c) the degree to which scientists succeed in building understanding with local communities through such methods as participatory rural appraisal,[24] as well as through rendering scientific information communicable.

Finally, limitations arose from the state of readiness and the capacity of interest groups to participate in the IEM process. Many of those who could read saw only the summary report or press articles, and commented on the basis of those alone. Those who did take the time to study the voluminous documents were pressed for time. This suggests that a more pro-active form of involving I&APs should be adopted by practitioners of EIAs, where early involvement, and the provision of access to relevant information in an understandable form, may offset these limitations.

Can the IEM process be improved?

Environmental impact assessment is practised in response to a project proposal, and should proceed within a more or less complete policy framework. Where EIAs are undertaken without a strong and dynamic policy, especially for regional and national development, the work runs the risk of either incorporating costly steps which would normally be extraneous to the EIA, or of an inadequate framework for a final decision. The St Lucia study has fallen into both traps. Our client was required to pay for work of a strategic nature, for example in the economic studies (which included work on refining the ecotourism development plan). Also, it is still not clear that rejection of the mining option would be optimum in terms of needed regional development and this may yet throw the decision open.

These circumstances are common to most if not all EIAs in developing regions. Strategic environmental assessment (SEA)[25] is offered as a method to provide a policy framework which properly addresses questions of environmental sustainability in national and regional development policies, and an anticipatory procedural framework which would contribute significantly to optimum EIAs for projects proposed within such strategies. SEA would also provide the environmental underpinning to South Africa's Reconstruction and Development Programme,[26] which presently it lacks.

South Africa's IEM policy[8] provides more than a framework for conducting EIAs, and represents a starting point for the development of an SEA framework. IEM was ahead of its time in South Africa — it was required to operate without any supporting legislation, and within a fragmented policy and legal framework. In the case of St Lucia, for example, bodies such as the departments of Environment Affairs, Water Affairs and Forestry, Mineral and Energy Affairs, the Natal Parks Board, and the Natal Provincial Administration were all responsible for aspects of the case in terms of existing environmental legislation.

Despite the drawbacks, IEM is surviving in the new South

Fig. 3. Schematic representation of the elements and instruments of policy relevant to environmentally sustainable development in developing and emerging economies. Abbreviations are as follows: SEA, strategic environmental assessments; IEM, integrated environmental management; EIA, environmental impact assessments; CBA, cost-benefit analysis; SM, simulation models; PRA, participatory rural appraisal.

Africa. The process is open and democratic, and it is what is envisaged for our new society. However, it would be ambitious to expect that the overall framework for regional development should come from IEM. Clearly, EIAs require a wider umbrella process to be effective (Fig. 3). To make the adoption of such a framework feasible in a country that cannot afford delays to urgently needed development, some form of rationalisation of the policy and legal framework, to improve the efficiency of environmental regulations, would be needed.

Conclusion

The St Lucia EIA has provided many valuable insights into the problems of achieving a balance between developmental and environmental goals. Not least of these are the insights gained into the role of science in such matters. While science can, and should, provide valuable inputs into the decision processes, it must also take cognisance of the uncertainties and ignorance that will influence its predictions, and the ways in which the social fabric within which it operates will create indeterminacies.

EIAs, in turn, will have to operate within a wider, and more clearly defined, framework of policy instruments to be useful and effective. The IEM procedure has done much to enhance the effectiveness of EIAs. In the case of St Lucia, for example, much value was added through public participation, and the detailed recommendations for a framework for managing the area went further than is usual for conventional EIAs. However, more is needed. The costs of developing and implementing strategic environmental assessments, and land-use policies (clearly the role of government rather than of individual developers) will have to be offset by more effective and rationalised environmental legislation.

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