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HEAVY INDUSTRY COMPARED TO AGRO-AQUACULTURE OPTIONS IN THE COEGA RIVER MOUTH AREA

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This paper weighs up the income and jobs generated by the heavy industry proposed in the Coega Industrial Development Zone (IDZ) project against those that would be generated by agriculture and aquaculture projects in the Coega River basin. It shows that a 'conservative scenario' heavy industry Coega IDZ option generates within South Africa almost three times as much income but less than half the number of jobs as a combined agro-aquaculture one (and about two times as much income if negative income effects are added in), and requires about 45 times as much capital.

In addition heavy industry may crowd other industries in the area. The conclusions drawn are:

- *that the opportunity cost of the Coega IDZ and Port Project is high, especially in terms of sustainable employment,*
- *that government should consider more carefully what the most efficient ways are of exploiting the natural capital of the area (the alluvial soils, the coastline and the supplies of fresh water),*
- *that if conflicts of interest between private sector interests are likely, there are dangers in development initiatives based on private-public partnerships, and*
- *that the heavy industry currently proposed for the Coega IDZ may limit the scope for future industrial developments in the area, by using up much of the 'safe' waste assimilating capacity of the air*

'N VERGELYKING TUSSEN SWAAR NYWERHEDE EN LANDBOU EN - WATER-KULTUURPROJEKTE IN DIE KOEGA-RIVIERSTROOMGEBIED

Hierdie artikel weeg die inkomme en werksgeleenthede wat gegenereer word deur die swaar industriële opsie van die Koega Industriële Ontwikkelingsone projek op teen die inkomme en werksgeleenthede wat gegenereer sou word deur landbou en -waterkultuurprojekte in die

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Koega-Rivierstroomgebied. Dit dui aan dat 'n konserwatiewe senario swaar industriële Koega Industriële Ontwikkelingsone in Suid Afrika omtrent 3 keer soveel inkome gegeneer, maar minder as 50 persent van die aantal werksgeleenthede as die landbou en -waterkultuur opsie, genereer (en omtrent 2 keer soveel inkome as negatiewe inkome-effekte bygetel word), en omtrent 45 keer soveel kapitaal benodig.

Daarby mag die swaar industriële projek ook ander bedrywe negatief beïnvloed. Die gevolgtrekkings wat gemaak word is:

- *dat die geleentheidskoste van die swaar industriële Koega Industriële Ontwikkelingsone hoog is, veral in terme van werksverskaffing,*
- *dat die regering meer sorgvuldige aandag moet skenk aan die mees doeltreffende maniere om die natuurlike kapitaal van die omgewing (die aangespoelde grond, die kuslyn en die voorraad van water) te ontgin,*
- *dat indien 'n konflik van belange tussen die private sektorbelange moontlik is, daar gevare aangaande inisiatiewe ontwikkelings wat gebaseer is op private-publieke vennootskappe bestaan, en*
- *dat die swaar industrie wat huidiglik voorgestel word vir die Koega Industriële Ontwikkelingsone die bestek vir toekomstige industriële ontwikkelinge in die omgewing mag beperk, deur meeste van die veilige afvalversamelende kapasiteit van die lug op te gebruik.*

1. INTRODUCTION

During the last three years discussions about regional development plans in the Eastern Cape have frequently focused attention on the concepts of clusters and spatial development initiatives (SDIs). Clusters are hives of industries, related by backward or forward linkages. They make up the building blocks of SDIs, which are development plans for specific geographically defined areas. The Department of Trade and Industry (DTI) are particularly enthusiastic about these initiatives and have held many workshops on them in the last year in the Eastern Cape. Their primary aim is the generation of sustainable employment (Department of Trade and Industry, 1997). There are two SDIs proposed by the DTI for the Eastern Cape. The Fish River SDI is proposed as an industrial one, although it includes much of the most productive agricultural land in the province (Hosking & Jauch, 1997). It incorporates the metropolises of both East London and Port Elizabeth, which together generate most the Eastern Cape's income. The Wild Coast SDI is proposed as an agro-tourism one. It is a plan of economic upliftment through the improvement of the infrastructure in what is a particularly poverty stricken part of the Eastern Cape, formerly known as the Transkei.

One of the clusters currently proposed for the Fish River SDI is the subject of this

paper, the Coega Industrial Development Zone (IDZ) and Harbour Project near Port Elizabeth. It is a cluster plan which aims at producing industrial goods at internationally competitive prices and exporting them. The anchor industry for the proposed cluster is a Zinc refinery. In order to get the project (cluster) off the ground a public-private partnership was established comprised of representatives of companies with an interest in investing in the area, the leadership of organised business in Port Elizabeth, Portnet and representatives of government. Over time the government have assumed the dominant role in the partnership.

A Bill enabling the building of the Coega harbour has already been passed by parliament, government ministers Alec Erwin and Pallo Jordan have repeatedly stated their support for the project and the main anchor tenant, Billiton (ex Gencor), has declared the Coega mouth to be their preferred site the building of their new zinc smelter (Eastern Province Herald, 1998: 1-2). Alec Erwin stated in parliament on 10 March, 1999, that the Coega project was expected to begin in the second half of 1999 (Eastern Province Herald, 1999: 1). By this time they hope to have added a second anchor project to the zinc refinery one.

This paper aims to make a contribution to knowledge about the proposed Coega industrial cluster by evaluating its opportunity cost. The evaluation proposed is in the form of a comparison between the permanent on-site (direct) income and employment generated by the Coega IDZ and Harbour Project and that generated by an agro-tourism alternative to it. For the sake of simplicity multiplier effects of the projects are ignored in both cases and no comparison made of the different income distribution effects which could result from them (labour/capital, urban/rural and East/West of the Eastern Cape).

The need for assessments of this type has been highlighted by one of South Africa's leading authorities on environmental assessment, Prof. Richard Fuggle. After his investigation of the *Strategic Environmental Assessment for The Proposed Industrial Development Zone and Harbour at Coega* (CSIR, 1997), commissioned by a Section 21 company brought into being specifically to promote the Coega IDZ, and published by the consultants (CSIR), Professor Richard Fuggle, concluded that:

The so-called Strategic Environmental Assessment is in my view incorrectly titled. This study is no more than a very general assessment of the proposed Coega project. There is no analysis of possible policy or programme alternatives:

no systematic comparison of alternatives, and no analysis of how existing activities (e.g. salt extraction, citrus farming, market gardening, dairying) will be affected by the new initiatives. It is simply not an Strategic Environmental Assessment as the term is generally understood in the professional literature. It is not a document that can be used to guide decision-makers at a strategic or policy level. (Fuggie, 1997).

One of its main gaps is the lack of 'assessment of policy and programme alternatives'; a gap this paper aims at addressing.

2. THE COEGA IDZ HEAVY INDUSTRY OPTION

The details of the Coega IDZ and Harbour Project have received considerable publicity in the local press of Port Elizabeth during the past 2 years. The proposed IDZ is for a mix of heavy and light industry and the proposed harbour is at the mouth of the Coega River. The primary motive for building the harbour is to reduce the substantial transport cost of the proposed heavy industry. A map of the proposed Coega IDZ (Figure 1) indicates that it covers about 10 000 ha - most of the area north-east of Motherwell and the Markman industrial area which lies to the south of the Sundays River.

In their economic assessment of the project Pakes & Nel (1997) sketch three scenarios for the project: a 'conservative' one, an 'optimistic' one and a 'high road' one. For the purposes of comparison, their scenario rating system was also utilized in describing an alternative to the Coega IDZ and Harbour Project (an agro-aquaculture option - see later).

- Conservative Scenario (Coega 1) - including only those anchor projects already firmly committed to the project:

 'Gencor' Zinc Refinery (*now Billiton*)

 Kynoch Phosphoric Acid Plant (*withdrawn and a replacement not yet found*)

 PPC Cement Plant

- Optimistic Scenario (Coega 2) - including above projects plus:

 Steel Mill

 Stainless Steel Plant

- High Road Scenario (Coega 3) - including all the above projects plus an

estimate of further growth, potentially including:

'Taiwanese' Petrochemical Industry
Willards Batteries
Powertech
Algorax
Air Liquid Foundry
Steel Mill Ore Process Plant

As could have been expected many changes have occurred since this list was compiled. Pakes and Nel (1997) were undoubtedly aware that this would occur and that is why they opted for scenario forecasts of the benefits of the project. Their concern was more with the probable scale of impact than with the details exactly which projects materialised.

The income and employment figures of the three scenarios are described in Table 1.

3. ESTIMATING INCOME LOSSES DUE TO THE COEGA IDZ PROJECT¹

3.1 Eco-tourism and recreation values/income

It was recognised at an early stage in the environmental impact assessment of the Coega project that eco-tourism would be an opportunity cost of it (CSIR, 1997: 253). What was not explored was how big this cost may actually be. The estimates provided below are intended to serve as a starting point for others to work on.

As a result of the Coega IDZ project recreational values associated with the following activities, *inter alia*, could be negatively affected:

- game park viewing in the Addo Elephant National Park,
- line fishing, hiking and bathing in the area around the proposed Coega IDZ,
- scuba diving around the St Croix Island group, and
- the viewing of the penguins on the St Croix Islands and the over 400 Southern Wright Whales which annually enter Algoa Bay.

Table 1: Investment, direct income and employment generated in the Coega IDZ project - selected scenarios

Scenario	Investment ¹ (millions of R)	Permanent Direct Income ² - EC (millions of R)	Permanent Direct Income - SA (millions of R)	Permanent Direct Employment
<i>(a) Conservative</i>				
New Port	1 275	12	12	100
Other Infrastructure	779	-	-	-
Gencor and Kynoch plants ³	2 325	179	272	750
PPC ⁴	(850)	-	-	-
Total - Conservative	4 379	191	284	850
<i>(b) Optimistic</i>				
Conserv. Total	4 379	191	284	850
Steel plants	6 500	780	not estimated	1 350
Total - Optimistic	10 879	971	not estimated	2 200
<i>(c) High Road</i>				
Optimist. Total	10 879	971	not estimated	2 200
Assumed others ⁵	940	116	not estimated	521
Total - High Road	11 819	1 087	not estimated	2 721

Sources: Based on Pakes and Nel (1997, Tables 22-33); Black and Saxby (1996); African Environmental Solutions (1997).

Notes:

- Total investment is shown, including both private and public, and imported and domestic components.
- By permanent is meant 25-40 years. After this period a process of plant decommissioning may be necessary.
- Slightly different figures are reported in African Environmental Solutions (1997) on the proposed Zinc Refinery and associated Phosphoric Acid Plant. From what is reported on p.6/6 in this document it appears that a total of R291,08 million per annum will be earned in South Africa on an investment (over 3 years) of R2087,4 million. Of the per annum income, R111,76 million will be paid out in costs to firms outside of the Eastern Cape and R179,76 million (8,6% of R2087 million) will accrue in the Eastern Cape as local costs (including wages) and return on investment. A curious figure in this report is that annual 'nett foreign exchange earnings to South Africa' are R720 million; R428,92 million more than the total earnings per annum accruing in South Africa in terms of the figures they are using (p.3 and p.14/2). It is also curious that economic reasons do not figure in the project motivation of this report (Chapter 2).
- PPC are included by Pakes and Nel (1997) in the construction phase of the project, but not in the operational phase. PPC have formally aligned themselves with the Coega project, but will yield the local economy no new benefits as they had already stated before the IDZ proposal was mooted that they were going to build a new factory in Port Elizabeth. A more consistent approach than that taken by Pakes and Nel (1997) would have been to have excluded PPC altogether from the investment, income and jobs analysis. The total investment figures shown in Table 1 exclude PPC's investment.
- The investment, extra permanent direct income and extra permanent direct employment attributed to the 'assumed others' (high road) are deduced using the same proportions as Pakes and Nel (1997) use with respect to the steel mill (their Table 33).

3.1.1 Game Park viewing

The National Parks Board has a vision of extending the Addo Elephant National Park to the mouth of the Sundays River; a vision most often referred to as the Greater Addo National Park Initiative (Anthony Hall-Martin, 1997). The aim is to incorporate the Addo Elephant National Park with a Eastern Cape Nature Conservation parks and purchased privately owned farm land in order to bring more than 400 000 ha under one conservation-management system and authority. This proposed park, the Greater Addo National Park, would consist of 6 biomes, ranging from marine coastline to Karoo scrub, through Alexandria and Afromontane forest, fynbos, savanna, grassland and valley thicket. A restocking programme has already begun with the intention of reintroducing all of the original fauna types, including 'the big five' (Anthony Hall-Martin, 1997).

The Coega IDZ is located between the proposed park and Port Elizabeth. The opportunity cost of the Coega IDZ, from the perspective of the proposed park, is the recreational value forgone as a result of the disadvantageous presence on its border and access route of heavy industry.

Beverley Geach (1997), using the Clawson & Knetsch (1966) travel cost method, estimated the existing Addo Elephant National Park's annual recreational value to be over R300 million (1996 price level). The Addo Elephant National Park receives about 80 000 visitors per annum, about half of which are foreign tourists. The Park itself collected about R2,4 million from these visitors in 1992 (about R3,4 million at a 1996 price level). Hotels, airlines, transport companies and other domestic businesses would have collected much more than this in providing services to these visitors. All these sums are included in the recreational valuation.

3.1.2 Recreational line fishing and other activities

Not much is known about the other recreational values listed above. Line fishing, bathing and the viewing of sand dunes, island and sea life attractions are popular in the area. Since 1996 whale watching has grown rapidly as a tourist attraction of Algoa Bay (Norbert Klages, 1997).

Smale and Buxton (1985: 142) felt that an estimate of the recreational value of the linefisheries in Algoa Bay was urgently needed (so that the importance of the industry could be properly documented). McGrath and Horner (1996) provide

us with some insight into the matter. Addressing a National Productivity Institute conference in Port Elizabeth they estimated that linefisheries in South Africa's coastal provinces generated about R2 167 million in income (about 1,3% of the GGP of these provinces) and about 131 560 jobs. If this proportion was generally applicable, the line fishery industry alone would have been worth about R200 million to the Port Elizabeth area in 1996.

Based on those studies that have been carried out, the total annual recreational value of the natural assets negatively affected by the Coega IDZ and Harbour Project could be in the region of R500 million (R300 million plus R200 million). If 10% of this is lost due to the Coega IDZ and Harbour Project, the opportunity cost of the project per annum in eco-tourism would be R50 million (at a 1996 price level).

3.2 Fishing income in Algoa Bay

The following potential effects of the Coega IDZ and Harbour Project on the Algoa Bay fisheries have been identified:

- an undermining the growth of phytoplankton, *Anaulus australis*, to the east of the proposed harbour, as a result of disruption to the water circulation patterns in the bay from harbour structures. The phytoplankton growth in the area between the Coega river mouth and the Sundays river mouth is critical in sustaining the food chain in Algoa Bay; the food chain upon which the fisheries depend.
- The closure of important fishing grounds as a result of increased commercial shipping in the area (Wooldridge, Klages and Smale, 1997).
- An increase of pollution in Algoa Bay (African Environmental Solutions and the CEN Integrated Environmental Management Unit, 1997:178, 180; Wooldridge, Klages & Smale, 1997).
- A dredging effect by currents in Algoa Bay, reduced photosynthetic activity, and disturbance of natural and anthropogenic contaminants in silts (African Environmental Solutions and the CEN Integrated Environmental Management Unit, 1997:175, 178, 180).

Understandably, many members of the fishing industry in Algoa Bay have

expressed concern about the impact on their incomes of the Coega IDZ (Rada Demain, 1997). The Chokka fishery in Algoa Bay is the third most productive in South Africa. It generated an income of about R66 million in 1993 (Norbert Klages, 1997) which is equivalent to about R85 million in 1996. It is estimated that the inshore trawl fishery landed a total of about 1 100 tons of fish (1 550 tons live weight) in Port Elizabeth during 1981, much of which was Hake (Smale & Buxton, 1985:141). As hake retailed for about R14/kg in Port Elizabeth in 1996, 1 100 tons of it would have fetched about R15 million. There also is a significant line fishery in the area (Wooldridge, Klages & Smale, 1997:27). During 1980 the catches were monitored of the 300 members of the Port Elizabeth Deep-Sea Angling Club and it was estimated that they caught about 32 tons of fish (Smale & Buxton, 1985:141). The value of this fish was about R328 000 (assuming R14/kg).

Actions undermining this industry give rise to opportunity costs. Assuming the undermining effect was 20%, the opportunity cost would be about R20 million per annum (20% of (R85 + R15) million, 1996 price level).

3.3 Farm income and the air emissions problem - the Sundays River citrus and vegetable yields, and animal products in the Coega and Alexandria areas

The Eastern Cape citrus industry, which earned about R523 000 000 from citrus exports in 1996, is projected to earn about R706 000 000 in 1997 (Outspan International, 1996). It employs about 19 000 people directly. Over 65% of this industry is located in the Coega and Sundays River Valleys. About one third of the cultivated area in these valleys is under vegetables (Clyde Niven, 1997).

This citrus industry may be threatened by emissions into the air and possibly wastes into subterranean water reserves from the heavy industries located in the Coega IDZ. According to the study commissioned for the environmental impact assessment, the level of fluoride emissions (from Gencor/Kynoch alone) can definitely be expected to injure plants in the Coega area, as well as for several kilometres along the narrow corridors of the predominant wind directions (Botha & Olbrich, 1997).

Secondly, with respect to the effects of sulphur dioxide emissions, the critical SO₂ levels for agricultural crops, forest trees and natural and semi natural vegetation are used. These are, respectively, 30, 20, and 20 ug/m³ (Norman Green, 1997).

The Gencor/Kynoch facility SO₂ levels are calculated in modelling exercises to reach a level of 15 ug/m³. It is unclear if this level includes the contribution of existing ambient levels within the proposed IDZ. The predicted normal ambient concentration of SO₂ in the air with the Gencor/Kynoch plant is 59 ug/m³ (83 ug/m³ in upset conditions), but the levels are expected to be much lower where agricultural crops are currently grown (CSIR, 1997:4.33). The PPC plant is expected to contribute further to the SO₂ levels in the area and is not included in the strategic environmental assessment calculations. For these reasons the addition of further industries, or expansion of the proposed ones, may push the levels of SO₂ and other air pollutants in the area close to or beyond the limit at which damage is expected to occur to plants in terms of Gencor's air modelling exercise.

Should the air quality in the Sundays River valley deteriorate to exceed the threshold levels of sensitive species, deleterious effects that may affect plant productivity may be experienced. More information is needed on current and predicted air quality levels to further quantify the potential impacts industrial development at Coega might have on vegetation (Botha & Olbrich, 1997:26).

It is unclear how sure the above scientists were that no deleterious effects occur at concentrations of SO₂ and other air pollutants over long periods of time higher than the current levels, but lower than the threshold levels they were working by.

Richard Fuggle (1997) found it 'unacceptable that the concerns of the citrus and agricultural industry have not been taken into account' in the strategic environmental assessment on the Coega IDZ project. Assuming Fuggle's concerns are well founded, and deleterious effects do occur, the following could be negatively affected:

- citrus and vegetable yields in the lower Sundays and Coega River valleys, and
- the output of animal products in the Coega and Alexandria areas.

Assuming that the undermining effect is equivalent to 7% of the citrus yield of the Sundays and Coega River valleys, a per annum income sacrifice will be made by the relevant farmers of about R23 million (7% of R340 million, 1996 price level).

3.4 Loss of income due to decreased human health of residents negatively affected in the area

Since the 1900s mortality rates have fallen for most major causes of death; the most conspicuous exception being cancer (even amongst cohorts in which the percentage of smokers has decreased - see Tietenberg, 1992:512). Increased exposure to toxic substances is thought to be a cause, although this is difficult to prove, due to the long latency periods for cancer (from 15 to 40 years). Based on the fact that the Gencor and Kynoch plants will substantially increase the levels of toxins in the area, an increase in the incidence of cancer could be expected amongst its residents some time after they commence production. In addition there may well be a negative effect on health in the short term.

Recent medical research on human beings shows that even in the short term there are adverse effects on human health from increased exposure to air pollutants, such as SO₂, and at lower levels than were previously thought, i.e. where the SO₂ concentration does not exceed 200 ug/m³ (Katsouyanni *et al.*, 1997:1658).

In Western European cities it was found that an increase of 50 ug/m³ in sulphur dioxide or black smoke was associated with a 3% increase in daily mortality. The corresponding figure for PM₁₀ (particulate matter smaller than 10 um in diameter) was 2% (Katsouyanni *et al.*, 1997:1658).

If 100 000 work days per year are lost due to increased pollutant levels in the environment, and each work day would generate R70, the health cost would be R7 million. The really big expense would be the transfers of income required to care for the sick (which could easily triple this cost).

A summary of the estimated negative impacts of the Coega IDZ and Harbour project is presented in Table 2 and the losses are subtracted from the income generated by the project in Table 3 in order to determine the net income gain.

4. AN AGRO-AQUACULTURE ALTERNATIVE TO THE COEGA IDZ PROJECT

The Eastern Cape Environmental Management Framework rated Coega as the most ecologically sensitive area in the region (Bambrolgh, 1999). For this reason it would appear imperative that any alternatives to the heavy industry proposed

Table 2: Estimates of the Negative Income and Recreational Value effects of the Coega IDZ and Harbour Project

<i>Production undermined by Coega IDZ project</i>	Income or Recreation Value Sacrifice (R millions)
1. Greater Addo Park and ecotourism ¹	50
2. Reduced fishing yields in Algoa Bay ²	20
3. Reduced citrus and vegetable yields in Sundays River valley ³	23
4. Ill health income losses ⁴	21
Total	114

Notes to Table 2

1. Based on 10% of estimated total annual recreational value estimated for Algoa Bay natural recreation assets.
2. Based on 20% of estimated annual income generated from commercial fishing in Algoa Bay.
3. Based on 7% of the value of the Sundays and Coega river valley citrus exports.
4. Based only on 100 000 working days lost per annum at R70/day plus R14 million for medical treatment of sick (double the gross earnings forgone).

Table 3: Net income generated in the Coega IDZ project - a conservative scenario

Project	Permanent Direct Income ² - EC (R millions)	Permanent Direct Income - SA (R millions)
New Port	12	12
Other Infrastructure	-	-
Gencor and Kynoch plants ³	179	272
PPC ⁴	-	-
<i>Gross income</i>	191	284
<i>Less negative environ. losses</i>	114	114
Net income gain	77	120

Source: Tables 1 and 2

for the Coega IDZ be carefully considered. One alternative is a mix of various existing and currently proposed agricultural and aquaculture projects in the area which would fall away if the Coega IDZ and harbour become a reality. Arguably,

it is a potentially a more environmentally attractive and sustainable alternative to the Coega IDZ and Harbour Project envisaged by Pakes & Nel (1997).

4.1 Citriculture

Water is a scarce resource in the Algoa Bay and its opportunity cost should be evaluated and incorporated in decision making on allocations between heavy users of it. The water requirement of the proposed Gencor/Kynoch complex is 13.32 ML/day (African Environmental Solutions, 1997:4/11). The average water demand for all existing industries in Port Elizabeth in 1996 was 14,6 ML/day (Silva McGillivray and the Port Elizabeth Municipality, 1997:32).

Current readily available bulk water supplies from local rivers are insufficient for Port Elizabeth, especially in times of drought. For this reason Port Elizabeth supplements its supplies from the Orange River system (Algoa Bay Water Resources System Analysis, 1993). It has no reason to look elsewhere for because it is only using a fraction of what it is informed by the Department of Water Affairs and Forestry is available to it from this scheme. For this reason it sees no problem in providing water in the future for 'its' heavy industries. On the other hand, the experience with water allocations of citrus farmers in the Sundays River valley during 1995, casts a shadow of doubt over just how much water is indeed available from the Orange River Scheme in times of drought (Clyde Niven, 1997). It has not been possible to purchase new water rights in the Sundays River since August 1993 (Clyde Niven, 1997).

Clearly there is a water issue related to the Coega IDZ and Harbour Project. It is not about whether there is sufficient water available for the proposed heavy industry, but whether the case heavy industry can make for using this water is stronger than that which can be made by other industries, for instance, agriculture. If the water is available, and it appears that it is, agriculture in the Eastern Cape would also like to stake a claim to it.

With this opportunity cost in mind three scenarios are presented in Table 4: a conservative one, an optimistic one and a high road one. In terms of the conservative scenario, the same quantity of water needed by the Gencor/Kynoch complex (13,32ML/day) is made available to citriculture in the lower Coega river valley. In terms of the optimistic and high road scenarios larger quantities of water are made available for citriculture in the lower Sundays river valley, 49,5 ML/day and 100ML/day respectively. This water is that which would otherwise

be used in Coega IDZ projects associated with the optimistic and high road scenarios (see Table 1).

The agricultural development of the lower Coega valley as prime citrus and peri-urban agricultural land has been proposed since the early 1930's (Clyde Niven, 1997). The limiting factor has consistently been the lack of water. As recently as 1988 an agricultural project was proposed here as a joint initiative between the Department of Agriculture and private landowners, but was again shelved due to water constraints. The land on which this project was proposed is identified as the lower Coega area in Table 4 and is 600 ha in size (see Coega River area in Figure 2 for location).

In terms of the Orange River Replanning Study, currently being undertaken by the Department of Water Affairs and Forestry, an area of about 2500 ha on the west bank of the Sundays River has been allocated for emergent Black farmers. This area runs from Barkly Bridge south to Tankatara annex. It is a substantial area of prime, alluvial, arable land - suitable for high intensity agriculture as soon as the water is available. This site, the location of which is also shown in Figure 2, is identified as the Logan Braes site in Table 4. In order to bring both the Lower Coega and Logan Braes sites into citrus production would require a bit less than 50 ML/day of water (see Appendix).

If 100 ML/day of water were made available to agriculture in the Coega and Sundays river basins, then besides the Lower Coega and Logan Braes sites, a further 3189 ha citrus elsewhere in the lower Sundays River (adjacent to existing areas under cultivation) could be brought under cultivation.

Estimates of the income and employment generated through the above projects are shown in Table 4. As is the case with Table 1, there are no multiplier impacts added in.

From Table 4 it is quite clear that despite massive differences in capital requirements, more jobs per one million litres of water are created in agriculture than in the proposed heavy industry. For each one million litres of water consumed per day (4 860 292 m³ annually), the proposed Gencor/Kynoch complex will generate about 56 permanent on site jobs and an annual income of about R20 423 000. By comparison, farming citrus in the lower Coega and Sundays river valleys will yield about 188 permanent on site jobs and an annual income of R4 389 000 (calculated using figures in the Appendix).

Table 4: Estimates of investment, direct income and employment generated in alternative scenarios to the Coega IDZ project

Scenarios of Projects and production forgone as a result of Coega IDZ project	Investment (R millions)	Permanent Direct Income - SA (R millions) ³	Permanent Direct Employment
<i>Conservative</i>			
Marine Growers/Sea Harvest 2 abalone farms ¹	30	40	350
Agricultural Projects with a 13,32 Ml/d water constraint:			
Lower Coega	48	42	1 200
Logan Braes ²	19	16	469
Total - Conserv.	97	98	2 019
<i>Optimistic</i>			
Marine Growers/Sea Harvest 5 abalone farms ¹	75	100	875
Agricultural Projects with a 49,29 Ml/d water constraint			
(i) Lower Coega	48	42	1 800
(ii) Logan Braes ²	200	175	5 000
Total - Optimistic	323	317	7 675
<i>High Road</i>			
Optimistic Scenario	323	317	7 675
Additional agricultural projects with a 100 Ml/d water constraint: 50,71 Ml/d in the Sundays and Coega Valleys ²	64	223	6 378
Total - High Rd.	387	540	14 053

Sources and Notes to Table 4:

1. Connie Muller (1997). Investment per farm is R15 million, gross income per farm is R20 million and employment per farm is 175.
2. See Appendix for income and employment figures. Investment based on R80 000 per ha. - for citrus.
3. Insufficient information was available to distinguish in income effects between the Eastern Cape and South Africa.

4.2 The cultivation of abalone

In the Coega harbour impact assessment it was accepted that an abalone farm in the Coega area may have to relocate as a result of the Coega project (African Environmental Solutions and the CEN Integrated Environmental Management Unit, 1997: 253). However, because it would be a relocation, Pakes & Nel (1997:73) did not regard it as an opportunity cost.

Based on discussions with the managing director of Marine Growers, Connie Muller, and other experts, a different perspective emerges: one which indicates that the potential for abalone cultivation in the area is much greater than the impression given in the African Environmental Solutions and the CEN Integrated Environmental Management Unit (1997) and the Pakes & Nel (1997) assessments. Relocation will not eliminate the opportunity cost.

In 1993 Johan Smit of 8CR Trust issued a prospectus in which he advertised 5 plots on his land in this area as being targeted and suitable for abalone farming. At about the same time a Pretoria based consulting company, Urban Economic Consultants carried out an analysis for the Port Elizabeth City Council of potential employment and income generating industries for the area. Aquaculture was identified as being one of the top five opportunities. One of the main reasons for the emergence of this business opportunity is that widespread poaching of abalone has eroded natural stocks to the point where the market has become dependent for supplies of abalone and many other types of shell fish on aquaculture.

As a result in 1995 Johan Smit was granted permission to subdivide his land and cultivate abalone on the plots. The first agreement he entered into was with Connie Muller, who now farms abalone on one of the plots. Since then Sea Harvest have purchased a 50% share in the Marine Growers business and together they plan to develop another similar operation on one of the other plots. Asian interest has been shown in developing one or more of the remaining plots.

Connie Muller estimates that each abalone farm unit requires an investment of R15 million in order to bring it into full production. The Marine Growers/Sea Harvest farm has not yet reached full production - it takes a number of years to get a farm to this state of development. When in full production each farm is anticipated to employ about 175 permanent staff (about 85% of whom are unskilled) and to yield about 80 tons of abalone per annum.

All of the abalone is exported. The price that this abalone could fetch in the export markets in 1996/7 was between R185 and R300/kg. At this price the per annum income yielded per abalone farm in 1996/7 would have been about R20 million (80 000 kgs at R260 per kg).

Abalone farming appears to be an industry, which should be given every encouragement possible. If other new farms can be developed elsewhere in the Eastern Cape, they will add to the region's income. However, the market for abalone is very sensitive to quality. Minimal additional contamination by heavy metals over and above existing levels would render the output worthless. Marine Growers are of the opinion that the introduction of a Zinc refinery and phosphoric acid plant into the area will bring about this contamination (Connie Muller, 1997). Norbert Klages (1997) shares the view of Marine Growers. He argues that, should the Coega IDZ proceed, Marine Growers farming operations will be excluded by the following: by heavy metal emissions into Algoa Bay, by harbour construction activities and by interference with the circulation patterns within Algoa Bay.

Based on the views of the managing director of Marine Growers, Connie Muller, and Norbert Klages it is deduced that the 5 abalone farms proposed in the area are an alternative to the Coega IDZ and port project (see Table 4).

4.3 Other industries potentially crowded out by the Coega IDZ project

4.3.1 Tourism

A major tourist investment proposal in the area is that of the Umtha Welanga consortium. The site of the proposed Umtha Welanga investment is south of the Coega mouth on what is known as Wells Estate. Umtha Welanga has purchased an option on this land. Umtha Welanga have proposed a R700 million recreation complex in the St Georges Strand/Wells Estate area: a casino run by Ladbrokes International, a five star hotel run by Hilton International Hotels, a Disney style water theme park, a community village, a golf course and a range of sporting facilities. The site for which they propose these developments overlaps the one which is earmarked for 'back of port' activities by the Coega IDZ project management team and is about 2-3 kilometres from the site of the proposed zinc smelter and phosphoric acid plant.

4.3.2 Solar salt reclamation

National Ingredients Suppliers operate a salt works with seawater and constructed salt pans in the Coega River estuary. If the current Coega IDZ and Harbour proposals are implemented the salt works will have to close down their operation in the estuary because they will be crowded out - their production processes will be interfered with.

4.3.3 Future industrial investment

Assuming that the estimated threshold air pollutant concentrations are adhered to, serious limitations will be imposed on the nature and scale of other industries which may be considered in the proposed 10 000 ha Coega IDZ. It stands to reason that if the plants of Gencor, Kynoch and PPC use up most of the 'safe' capacity available in the air to assimilate pollutants, others after them will be constrained in what they can do, and the Coega IDZ site will be less appealing to these other prospective investors.

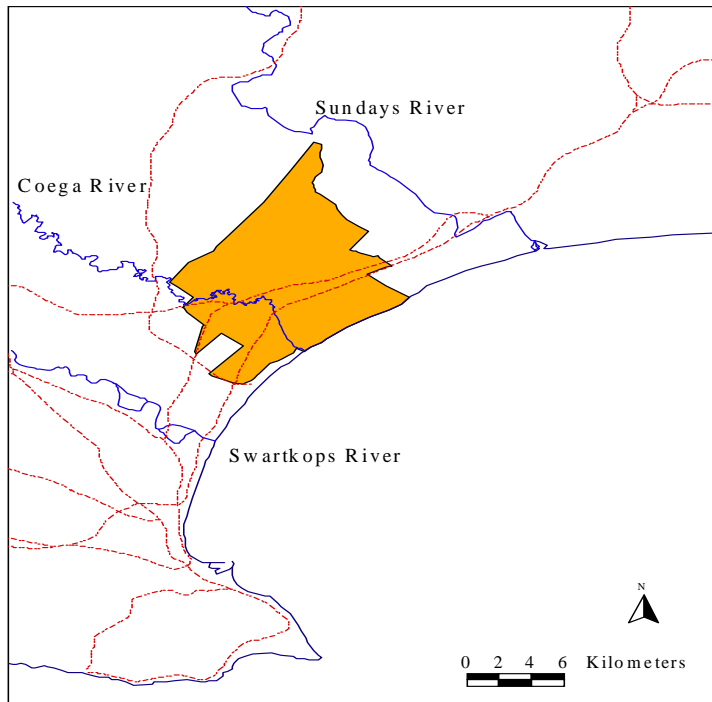


Figure 1: Map of Coega IDZ

Conclusions on the opportunity cost of the Coega IDZ and Harbour Project

The aquaculture and agriculture totals in Table 4 are an estimate of the agro-aquaculture opportunity cost of the Coega IDZ and Harbour Project. Conversely,

the Coega IDZ totals listed in Table 3 are an estimate of the opportunity cost of the agro-aquaculture options in the Coega area. The two projects are opportunity costs for each other in the context of a specific area of land (see Figures 1 and 2). They are weak measures of opportunity cost in that each option does not preclude projects associated with the other option from being initiated elsewhere by the proposing firms or competitors of theirs.

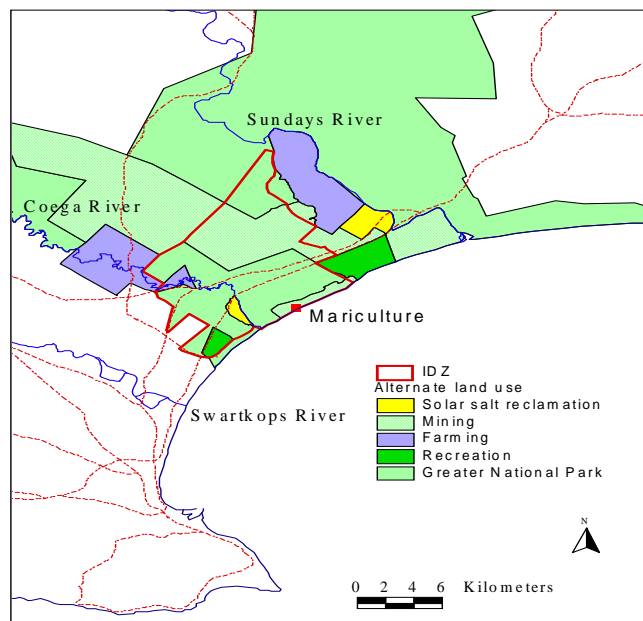


Figure 2: Map showing an alternative to the Coega IDZ

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APPENDIX:

THE CALCULATION OF INCOME AND JOBS IN AGRICULTURE IN THE COEGA AREA

The amount income and number of jobs generated per hectare of agricultural land depend on many things, for instance, the type of crop, the efficiency of farming operations, the type of irrigation regime required, the state of the market and a number of stochastic factors. For citrus in the Coega area the water requirements are of particular importance.

Water requirements per hectare

The Department of Agriculture's (1996) *Estimated Irrigation Requirements of Crops in South Africa* states that in the Addo region a 25mm replacement irrigation regime requires:

- 735 mm water per hectare per annum for citrus,
- 147 mm water per hectare per annum for green peas, and
- 535 mm water per hectare per annum for green peas.

These irrigation regimes take no account of evaporation or precipitation. Assuming 80% watering efficiency, the quantity of irrigation water lost due to evaporation is 147mm. This loss increases the irrigation requirement up to about 882 mm water per hectare per annum. However, assuming 300 mm annual rainfall, two-thirds of the annual average in the lower Coega area, the irrigation requirement is reduced to 582 mm water per hectare per annum, and:

$582 \text{ mm/ha/a} = 5,82 \text{ MI/ha/a} = 0,0159 \text{ MI/ha/d}$, so that 1 MI/d is sufficient to irrigate about 62,7 ha/a,

where

MI = million litres of water.

The Gencor-Kynoch complex is expected to use about 13,318 MI/day (African Environmental Solutions, 1997:4/11). With an equivalent amount of water it is estimated that about $13,3 \times 62,7 = 834,5$ ha could be irrigated.

In order to irrigate the 600 ha Lower Coega area about 9,54 Ml/d would be required and to irrigate the 2 500 ha Logan Braes area about 39,75 Ml/d would be required.

Income yield per hectare from citrus

The following income returns per hectare per annum were estimated in a study of the Sundays Valley citrus industry commissioned by Outspan International in 1996 (Van Zyl & Ferreira, 1996). The income yields only become applicable once the citrus is fully established (about 4-7 years).

<u>Citrus type</u>	<u>Income yield/ha/a (1995 price levels)</u>
Navels	R58 111
Valencias	R62 784
Soft Citrus	R91 314
Lemons	R94 226

If a mix of citrus were cultivated an average income yield per hectare per annum could be expected of about R70 000; the figure used as the basis for estimation in Table 4.

Jobs generated per hectare from citrus farming

The number of jobs generated per hectare depend upon the type of crop farmed and the level of mechanization utilized. In commercial citrus farming about 2 jobs per hectare are generated in commercial farming (Clyde Niven, 1997).

Income and jobs from the Lower Coega area

$$\begin{aligned} \text{Income} &= 600 \times \text{R}70\,000 = \text{R}42\text{m/a} \\ \text{Jobs} &= 600 \times 2 = 1\,200 \end{aligned}$$

Income and jobs from the Logan Braes area

Conservative Scenario:

$$\begin{aligned} \text{Income} &= 234,5 \times \text{R}70\,000 = \text{R}16,415\text{m/a} \\ \text{Jobs} &= 234,5 \times 2 = 469 \end{aligned}$$

Optimistic Scenario:

Income = 2 500 x R70 000 = R175m/a
 Jobs = 2500 x 2 = 5 000

Income and jobs in the high road scenario

If 100 Ml/d water were available to agriculture, a further 50,71 Ml/d would be available over and above the 49,29 used at the Lower Coega and Logan Braes sites. With 50,71 Ml/d a further 3189 ha citrus could be brought under irrigation in the Sundays and Coega River basins. This citrus would generate:

Income = 3189 x R70 000 = R223,23 m/a
 Jobs = 3189 x 2 = 6 378

Income and Jobs comparisons between Gencor/Kynoch and citrus farming per Ml/d water utilization

	<u>Gencor/Kynoch</u>	<u>Citrus Farming</u>
Income per annum (RSA)	R20 423 000	R4 389 000
Jobs	56	188