143

UNITED NATIONS
ECONOMIC COMMISSION
FOR AFRICA

NATIONS UNIES
COMMISSION ECONOMIQUE
POUR L'AFRIQUE

MULTINATIONAL PROGRAMMING AND OPERATIONAL CENTRE
(ECA/MULPOC) FOR EASTERN AND SOUTHERN AFRICA

Distr.
LIMITED

ECA/MULPOC/LUS/ICE/IV/7&8
March, 1997

Original: ENGLISH

FOURTH MEETING OF THE INTERGOVERNMENTAL
COMMITTEE OF EXPERTS (ICE)

PRETORIA, REPUBLIC OF SOUTH AFRICA
24-28 MARCH, 1997

INTEGRATION OF SOUTH AFRICA INTO SOUTHERN AFRICA
A MINING PERSPECTIVE

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EXECUTIVE SUMMARY

This report presents an assessment of the prospects for the integration of South Africa into the Southern African mining industry, which was undertaken by the Lusaka-based MULPOC. The assessment was conducted as part of the work programme and priorities of the MULPOC at the request of the member States

The Current Situation

The report reviews the comparative mineral potential and production of the southern Africa in world terms. The subregion has an exceptional mineral endowment particularly in the minerals manganese, chromite, platinum group metals, gold, vanadium and alumino-silicates. It also has substantial quantities of diamonds, copper, cobalt, titanium, and other minerals. In line with the resource endowment, a world-class mining industry has evolved in a number of the member States of the subregion. The potential of this mining industry is, however, much higher than currently exploited. This is due to a number of constraints in most of the member States.

The major constraints have been identified as the:

(a) lack of risk capital for exploration and mine development. This arises primarily from previous mineral policies which acted as disincentives to private sector participation in the minerals industry;

(b) the generally poor R&D facilities in most countries which results in poor access to mining and extraction technologies and inhibits the creation of beneficiated and value-added mineral products;

(c) the limited distribution of facilities for human resources development which has resulted in qualitative and quantitative shortages of skills and competences.

South Africa's strength in these areas has been reviewed at length. With respect to exploration and mine development

activities, the interest of South African mining corporations in the subregion has been growing, along with their exploration and mine finance budgets. Southern Africa, however, has to compete with other world mining regions for risk finance. This finance is unlikely to come from domestic sources in South Africa, in the short term. It is most likely to come from the international money markets.

The report further reviews the many mining and extraction technologies which have been developed locally in South Africa. The technologies have evolved due to a presence of world-class research institutes which have an excellent interface with industry. These have been responsible for South Africa's large and competitive mineral sector. They have also been responsible for South Africa achieving a higher degree of beneficiation, particularly to the stage of alloy manufacture. As the mining corporations expand their horizon, proprietary technologies have become a leveraging point. South Africa's numerous mineral-based academic institutes have also made a major contribution to its thriving mineral sector.

The major issues and Agenda for Integration

The report examines the existing linkages in the mineral sector of southern Africa. There is already a high degree of common mine ownership, equipment sources and use of shared research, and academic facilities. Most Governments are nevertheless concerned that the power and domination of the industry by South African corporations has historically led to inequities in the industry, a condition which is likely to persist unless the situation is addressed. The overwhelming technological superiority of South Africa, may also preclude equitable integration. The mining corporations, on the other hand, insist that the mining codes of southern Africa, as a whole, need improvement in fiscal incentives, legislative framework and administrative inefficiencies.

These concerns can be substantially eliminated and integration enhanced by:

(a) improving the mineral legislation to bring it in line with other world mining regions;

(b) not curtailing the activities of the corporations which would only force them to relocate their activities;

(c) governments working towards a common framework for reducing the subregion's investment risk profile;

(d) governments passively participating in equity for, large projects, to increase partnership;

(e) introduction of unified skills and competency definition to avoid discriminatory tendencies, coupled with short term positive discrimination to increase the number of qualified local people.

These recommendations will need an institutional framework to implement. It is recommended that Government Departments, as well as the SADC Mining Sector, be strengthened with strategic management skills. The latter should be turned into a Southern African Minerals Commission to enable it better implement the broad mandate of integrating the mineral sector.

The report contends that the object of integration is to increase the global competitive advantage of the region's mineral industry. This can only happen if both lower order factor conditions (such as minerals and energy) and higher order factors (such as skills and technology) are exploited within an integrated southern Africa. South Africa has both of these while the rest of the subregion has an abundance of the former. In this connection, efforts should be made to transform, Mintek, South Africa's major source of proprietary extraction technologies, into a subregional institute.

With respect to mineral-specific mining ventures, these will evolve along the lines of maximising the mix of factor conditions. The minerals favoured are those whose endowment is large and can sustain long term operations, and ensure a significant market segment. These include ferro-manganese, ferro-chrome, platinum and

titanium sands. Indeed a number of new and potential ventures for these mineral are already under implementation. Attention should also be given to the base metal sector (copper, nickel, lead and zinc) where there is a conspicuous lack of coordination and many existing facilities face closure. New and potential production could prevent such closures.

ACKNOWLEDGEMENTS

The Lusaka-based ECA/MULPOC gratefully acknowledges the assistance received from many, individuals and institutions during the missions to acquire data for this study. Specific mention must be made of the following people who acted as perfect hosts to the missions and made excellent arrangements and contacts for the meetings.

Botswana	-	Mr. K. Abi Ministry of Mineral Resources and Water Affairs
Namibia	-	Mr. A. Mudhika Ministry of Mines and Energy
South Africa	-	Dr. N. Grobler Department of Minerals and Energy
Zimbabwe	-	Mr. S. N'cube Ministry of Mines

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ABBREVIATIONS AND ACRONYMS

AAC	-	Anglo American Corporation
ADB	-	African Development Bank
Ang.	-	Angola
BCL	-	Bamangwato Consolidated Limited
BHP	-	Broken Hill Proprietary Corporation
Bot.	-	Botswana
Bimco	-	Bucha Iron Mining Company
CDM	-	Campanhia de Desenvovimento Mineiro
CSIR	-	Council for Scientific and Industrial Research
CIP	-	Carbon-in-pulp
DC	-	Direct current
ECA/MULPOC	-	Economic Commission for Africa/Multinational Programming and Operational Centre
EPZ	-	Export Processing Zone
ESMRDC	-	Eastern and Southern African Mineral Resources Development Centre
GDP	-	Gross Domestic Product
GFN	-	Gold Fields of Namibia
HBI	-	Hot Briquetted Iron
ISCOR	-	Iron and Steel Corporation
IMR	-	Institute of Mining Research
JCI	-	Johannesburg Consolidated Investments
JSE	-	Johannesburg Stock Exchange
JMC	-	Japan Metals and Chemicals
Km	-	Kilometre
LME	-	London Metal Exchange
Mal.	-	Malawi
Moz.	-	Mozambique
MW	-	Mega Watts
MMCZ	-	Mineral Marketing Corporation of Zimbabwe
Nam.	-	Namibia
RDP	-	Reconstruction and Development Plan
SA, RSA	-	Republic of South Africa
SAECI	-	South African Explosives and Chemical Industries
SADC	-	Southern African Development Community
STAMICO	-	State Mining Corporation
SHC	-	Southern Health Care

SACU	-	Southern African Customs Union
SAPP	-	Southern African Power Pool
Tan.	-	Tanzania
TAZARA	-	Tanzania Zambia Railways Authority
UNU	-	United Nations University
UNECA	-	United Nations Economic Commission for Africa
Zam.	-	Zambia
Zim.	-	Zimbabwe
ZCCM	-	Zambia Consolidated Copper Mines
ZMDC	-	Zimbabwe Mining Development Corporation

1 INTRODUCTION

The southern African subregion is a repository to some of the world's major mineral resources. The subregion possesses the world's largest deposits of alumino-silicates, chromium, gold manganese, platinum group metals and vanadium. In addition, the subregion has world notable reserves of copper and other base metals, iron ore, coal, diamonds, heavy mineral sands and many other minerals. In line with the exceptional mineral endowment, a large world-class mining sector has evolved in the subregion as a whole. However, in several of the countries, mineral output has been declining, not due to the exhaustion of mineable reserves, but on account of institutional weaknesses intrinsic within the industry. Even in the countries where mineral output has been increasing, there has been disquiet over continuing weaknesses in the mining industry.

The democratisation of South Africa in 1994 has heightened expectations that the mining industry can support the process of economic reconstruction and growth in the subregion, if only because of its capacity to earn foreign exchange in the short term. This has given birth to a growing awareness and anticipation that cooperation and integration of the southern African mining industry could add impetus to economic growth, especially given the large resource endowment and the perceived strength of the South African minerals sector, which is one of the largest in the world. However, not many studies have been conducted to establish what synergies exist and the form in which this cooperation and integration is likely to proceed.

A notable study, to assess the prospects of economic integration in southern Africa, was undertaken by the African Development Bank (ADB) between 1991 and 1993. The study examined the issue of integration in various economic sectors including mining. Due to the fact that the study report was completed before the democratic changes in South Africa, coupled with the passage of time, the report does not address some of the concerns which still persist. For example, the ADB report did not fully analyze the competitive factors which South Africa, and the other countries,

would bring to the process of economic integration. As a result, issues such as the nexus between the roles of the mining corporations and the Governments, on the one hand, and the concerns of domination of the other member States by South Africa, were insufficiently addressed. Thus the object to be served by economic integration remained somewhat obscure.

In the light of the growing importance of the minerals industry to the process of economic integration in southern Africa, the Lusaka-based ECA/MULPOC was requested by its member States to undertake two studies. These were: "Integration of South Africa into Southern Africa Through Mining Ventures" and "Cooperation in the Development and Utilisation of Selected Mineral Resources in Southern Africa". There is a common thread which runs through the two studies. Mining ventures imply the development of specific (or selected) mineral resources. Furthermore, an assessment of cooperation and integration of the minerals industry in southern Africa would be futile without analyzing the underlying premises expected to govern the development and growth of mining ventures. For these reasons, the two studies were combined into a broad-based study and the title changed to: "Integration of South Africa into Southern Africa: a Mining Perspective". This allowed for the process of cooperation and integration to be put in its logical perspective taking into account the current synergies which exist in southern Africa.

This report presents the findings of the study. It reviews the comparative resource endowment and the structure of the mineral's industry in southern Africa. It further analyses the strengths and weaknesses of the industry from the viewpoint of: availability of risk capital for exploration and mine development; technological capacity as embodied in R & D and facilities for higher level skills; beneficiation and value added; and the existing inter-linkages in the mineral industry of southern Africa. The report considers the role of these and other factor conditions in terms of creating a subregional mining industry with a global competitive advantage.

The major finding of the report is that southern Africa, as a whole, has many positive factors which favour the emergence of a globally competitive mining industry. Many countries in the subregion have abundant lower order factors (such as mineral resources and energy), while South Africa additionally possesses higher order factors (such as proprietary technologies and research facilities). However, global competitiveness will not come about by curtailing the activities of the South African mining corporations, a matter of concern to most Governments in the subregion. Rather the challenge, and object, of integration lies in promoting a subregional policy framework which allows for the full range of factor conditions to be exploited by the private sector. Within such a policy framework, there is need for strengthening institutional mechanisms at the national and subregional levels to promote economic integration. The report contends that South Africa's strong technological capacity, the subregion's endowment in factor conditions and the global predatory nature of its mining corporations are all necessary pre-requisites to a global competitive advantage of southern Africa's mining industry. The exploitation of specific minerals will be governed by these considerations.

This report should raise a number of fundamental issues in the way integration is viewed in the mining industries of southern Africa. Much care has been taken to verify the information given. Nevertheless, comments and corrections are invited to broaden the report's depth. These should be submitted to the Lusaka-based ECA/MULPOC.

2. OVERVIEW OF THE MINERAL SECTOR OF SOUTHERN AFRICA

2.1 The Role of Mining in the Economies of Southern Africa

Mining has been a major economic activity in southern Africa since the discovery and subsequent extraction of gold and diamonds in South Africa in the second half of the 19th century. Since then, the industry has grown into the subregion's most significant foreign exchange earner, a large scale employer and a significant contributor to the GDP. Table 1 demonstrates the economic importance of mining to the economies of the Southern African Development Community (SADC) countries in 1990 (1,2). The table shows that mining accounted for an average of US$15 billion or 60 per cent of foreign exchange earnings, 10 per cent of GDP and employed about 5 per cent of the total wage earners in the formal sector. In some six countries of the subregion, namely: Angola,

Table 1: Role of Mining in the Economies of Southern African countries in 1990

Country	Mining, US$ million		Mining as percent of total		
	Total	Export	GDP	Exports	Employment
Angola	243	243	2.9	7.6	-
Botswana	1,545	1550	50.0	88.4	3.0
Lesotho	2	2	0.5	-	-
Malawi	15	0	0.3	0	0.1
Mozambique	4	4	0.2	2.9	6.2
Namibia	410	780	30.0	60.6	-
Swaziland	25	22	1.7	5.5[a]	2.3[b]
Tanzania	25	29	1.2	0.8	0.1
Zambia	1,400	634	10.0	92.6	15.1
Zimbabwe	440	438	8.2	31.7[b]	3.8[b]
South Africa[b]	13,804	11,212	8.7	48.7	4.1
Region	17.913	14,914	10	60	4.7

Source: Mintek 1995 (2)

a: 1992 figures
b: 1993 figures

Botswana, Namibia, South Africa, Zambia and Zimbabwe, mining is probably the most important sector in the national economies. However, even in the non-traditional mining countries, such as

Malawi and Tanzania, the contribution of the mining industry to the national economy has been increasing in recent years.

The economic impact of mining in southern Africa, however transcends foreign exchange earnings and employment creation. The industry has been largely responsible for the growth of the utilities and other economic sectors. In 1990, the mining industry purchased a third of the total electrical energy sold in Zimbabwe, 23% of that sold in South Africa in 1993 and some 70% of that distributed in Zambia in 1996 (3,4). In terms of railway cargo, the industry accounted for 51% of the total export tonnage and 45% of internal traffic railway movements in Zimbabwe in 1990 while in Zambia, the equivalent fraction for exports moved in 1996 by the Tanzania-Zambia Railway Authority (TAZARA) and internal tonnages by Zambia Railways were 69% and 73%, respectively. In terms of energy sources, 93% of the energy generated in 1993 in South Africa came from mining sources through coal fired power stations (4). Similarly, coal fired electric energy, consumed predominantly by mining operations, is the major internal source of power in Botswana.

In the social sector, mining companies are important contributors to health services, education and housing. In some cases, such as the Anglo American Corporation, dedicated health care associate companies[1] offer private medical facilities. In Zimbabwe, the industry in 1990 provided nine hospitals, 51 clinics, 38 doctors, housing for 330,000 people and 40,000 school places (3) while in Zambia, the industry provides a total of 11 hospitals, numerous schools and owns the major part of housing stock in the seven towns located in the copper belt mining region.

Due to this ability of the industry to generate broad-based economic growth, southern African countries have in recent years increasingly emphasised mining as the key to their rapid socio-economic transformation.

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[1] Southern Health Care JV (SHC) is a joint venture between Anglo and Associates (40%), Southern Life (40%) and Health Care Corporation of USA (20%).

2.2 Comparative Mineral Potential and Production in Southern Africa

The growth of the large mineral sector in southern Africa owes much to the presence of world class mineral reserves in the subregion. Table 2 shows the comparative mineral potential of southern Africa in world terms. The region, and South Africa in particular, possesses the largest world reserves in six minerals, namely: manganese (81%), chromium (89%), platinum group metals[2] (56%), gold (45%), vanadium (45%) and alumino-silicates (37%). In addition, the region possesses significant reserves of other minerals including zirconium, titanium, antimony, phosphate rock, copper and cobalt, as well as the energy minerals uranium and coal. Significantly, Zimbabwe possesses the largest concentration of chromium, and platinum reserves after South Africa, while the copper and cobalt resources of Zambia are also notable.

Table 3 gives a comparative view of mineral production in southern Africa in world terms. It is evident that the region, led by South Africa, are major producers of a number of minerals, much along the patterns of the resource endowment. The table indicates that the region is the world's biggest producer of gold (27.2%), platinum (54.4%), chromium (33.5%), vanadium (46.4%) and uranium (9.3%). The region also contributes significantly to the world production of diamonds (for which Botswana is the world's third largest producer), copper, cobalt, and nickel.

Although Table 2 illustrates the dominance of South Africa's mineral resource base, it significantly underestimates the large mineral endowment which exists in southern Africa as a whole. This is largely due to substantial under exploration which characterised much of sub-Saharan Africa particularly during the 1980s (1) relative to South Africa. As a direct result, the mineral resources of southern Africa are not generally as fully

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[2] Platinum group metals comprise six mineral types namely: platinum, iridium, osmium, palladium, rhodium and ruthenium.

Table 2: Comparative Mineral Reserve Base[a] of Southern Africa in 1995

Mineral Commodity	South Africa			Nam.[b]	Zim.[b]	Zam.[b]	Bot.	Southern Africa excluding SA	
	Tonnes	World %	Rank					World %	Rank
Manganese	4,000	81	1						
Chromium	3,200	69	1		930			20.9	2
Platinum Group Metals(Kt)	62,816	56	1						
Gold (Kt)	39,933	46	1						
Vanadium	22.5	45	1						
Alumino Silicates (ore)	50.8	37	1						
Zirconium	14.3	26	2						
Titanium	72	17	2						
Antimony (kt)	250	5	2						
Phosphate Rock (concentrates)	2,310	7	3						
Zinc	15	5	4						
Coal	55,300	11	5						
Nickel	11.8	10	5		0.1		0.9	0.8	11
Uranium	179.1	6	6	80.6				5.3	7
Copper	13	2	12			34		5.7	5
Cobalt[b] (Kt)	15	0.2	8			540		6.1	4

Source: Chamber of Mines of South Africa, 1995, Minerals Bureau, Department of Energy and Minerals, 1993/1994

Notes: a: Contained metal in millions of tonnes unless specified
b: 1993 figures

Table 3: Comparative Mineral Production in Southern Africa in 1993

Mineral Commodity	South Africa			Ang	Bot	Nam	Zim	Zam	Southern Africa excluding SA	
	World								World	
	Tonnes	%	Rank						%	Rank
Rough Diamonds[a] ('000 carats)	10,177	10.5	5	900	15,946	1,549			18	2
Gold (metal)	619.2	27.2	1							
Platinum[a] (kg metal)	152,891	54.4	1							
Coal (millions)	182.2	5.3	6							
Uranium[a] (metal)	1,669	4.6	8			1,684			4.7	1
Antimony (metal)	4,111	9.8	4							
Chromium (Kt metal)	2,826.7	33.5	1				264.4		3.1	8
Cobalt[a] (metal)	234	0.8	8					4,610	15.3	3
Copper (Kt metal)	189	2.1	13					418	4.6	5
Ferromanganese* (metal)	536.4	8.7	4							
Nickel[a] (Kt metal)	37.9	4.4	6		18.9					
Titanium (Kt metal)	758	20.8	2				10.3		3.4	10
Vanadium (V_2O_5)	26,870	46.4	1							
Zirconium (Kt)	230	32.7	2							

Source: Minerals Bureau, Department of mineral and Energy, 1993

Notes: a: 1992 figures.

characterised as those of South Africa. For example, the greenstone belts of northwest Tanzania and Zimbabwe, which host considerable gold resources, have not been fully explored. Gold resources are also known to exist in Angola, Mozambique and Zambia but these have also not been explored. Despite the incomplete knowledge on potential, Zimbabwe is a significant producer of gold with an output of some 22 tonnes in 1995, the third largest after South Africa and Ghana, and ranks in the top 20 world producers (6).

While the platinum resources of the Bushveld Complex in South Africa are well explored and have been exploited on a large scale, those of the Great Dyke in Zimbabwe have not been exploited to a similar extent. Recent exploration has, however, resulted in two major platinum projects currently under implementation. The larger of the two is the US $264 million Hartley Mine, a joint venture between the Broken Hill Proprietary Company (BHP) and Delta Gold N.L., both of Australia, which will produce 150,000 oz of platinum from a throughput of 2.16 million tonnes per year. This will account for approximately 3.5% of the world's current output when full mine production is reached during 1997. The mine has been planned with the intention of early expansion to a throughput of 4.3 million tonnes of ore and a world market share of 7% of platinum output. At the smaller Mimosa Platinum Mine of the Zimbabwe Mining and Smelting Company (ZIMASCO), production is expected to reach 75,000 oz by the end of the decade (6). These projects will make Zimbabwe the second largest producer of platinum after South Africa and increase southern Africa's world share of platinum output to well over 60% (6).

The Karoo sequence spanning southern Africa is host to extensive coal resources. Although Table 2 indicates South Africa's known reserves at about 55 billion tonnes, Botswana has reserves of 17 billion, Mozambique nine billion, Swaziland five billion, Zimbabwe 2 billion, Tanzania 2 billion and Zambia 0.3 billion (8). These coal resources considerably add to the reserve base reported in Table 2, but are not exploited to the same extent as in South Africa. Whereas South African production of coal was 230 million tonnes in 1994, it was 4 million tonnes in Zimbabwe in 1993, and

900,000 tonnes in Botswana in 1996. Production was insignificant in the other southern African countries. It is worth noting that the larger part of production in these countries, as in South Africa, was used for electricity generation (8).

Southern Africa possesses other significant mineral resources not shown in Table 2, more notably industrial minerals[3] of which significant reserves include the heavy titanium mineral sands in Mozambique with reserves of 348 million tonnes, large commercial scale phosphates in Mozambique, Tanzania and Zimbabwe, and many other varieties of industrial minerals. The potential for gemstone[4] resources is also very high, particularly in Mozambique, Namibia, Tanzania and Zambia where small scale, and often illicit, mining of a wide range of gemstones currently takes place. Like many mineral deposits, the industrial minerals and gemstones of the subregion have not been fully explored and statistics on available reserves and formal production are sparse.

The exceptional mineral endowment of southern Africa invites the increasingly popular notion that mineral-led industrialisation and economic integration is possible given the sum total of the region's factors of production, to which the entry of South Africa into the subregion has greatly added. This view is shared by Ian Spence, an economist with Goldfields[5] (9):

> Regionalisation is becoming a factor in developing competitive ability...Regionalisation is, however, unlikely to develop quickly outside

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3 For an excellent review of the industrial minerals potential in southern Africa, see: Council for Geoscience, Proceedings 1995 International Conference on Industrial Minerals: Investment Opportunities in Southern Africa, Eds. Mambwe S.H, Simukanga S., Sikazwe O.N. and Kamona F., 1995. See also W.C. Lombe, Industrial Minerals in Eastern and Southern Africa - a review of resource potential, ibid.

4 The ECA/MULPOC report ECA/MULPOC/LUS/ICE/III/9, Study of Gemstone Development and Marketing Strategies in Eastern and southern Africa, 1995, gives a good review of the gemstone resources of the subregion and the difficulties of quantifying these resources.

5 Goldfields is one of the six major mining houses in South Africa

> southern Africa. The industrial strength of South Africa, as the motor for regional growth, gives the region much greater growth potential

Much as the potential for regional economic integration is bright many weaknesses in the industry persist and a clear understanding of the synergies that exist, particularly those offered by South Africa, is the starting point.

3. SOUTHERN AFRICA'S WEAKNESSES AND SOUTH AFRICA'S POTENTIAL TO CONTRIBUTE TO MINERAL-BASED ECONOMIC INTEGRATION

As indicated above, the mineral resources exploitation in southern Africa has generally been incongruous with the generous resource endowment with the exception of South Africa and possibly one or two other countries. There are many varied reasons for the under-performance of the mining industry in southern Africa. The major ones relate to institutional inadequacies and are outlined below.

3.1 Availability of Risk Capital for Exploration and Mine Development

3.1.1 Traditional Weaknesses

A major reason often cited for the stagnation and decline in mining output in several southern African countries is the lack of risk finance for exploration and mine development. The World Bank notes that (1):

> ..the major (global) mining countries attracted investment of up to 10% of mineral production value in exploration in contrast to sub-saharan African countries which attracted investment of about 1% of the value of mineral production in the 1980s. Between 1980 and 1989, South Africa attracted US$ 180 million in exploration expenditure compared to US$ 100 million for the rest of Sub-Saharan Africa.

Mining investment is very structured and always begins with mineral exploration to identify potential targets for mine development. The lack of serious investment in exploration in much of southern Africa therefore robbed the subregion of a pipeline of

investment opportunities. The point is well-made in a number of policy studies (1,5) that mining is one of the few truly global businesses in which mining capital from major multinational companies compete for prime mineral deposits. It is therefore not surprising that mining output suffered most in those countries of southern Africa where mining assets were nationalised and control passed into the hands of the emerging parastatal structures. A prime example is the deterioration of copper mining assets[6] in Zambia where copper output fell from a peak of 755,000 tonnes in 1969 to a record low of 350,476 tonnes in 1995, with the consequence of an increased debt overhang to finance both capital and operation costs (1,10,11). Other equally indistinguished examples in the subregion include: Tanzania, where diamond production has declined from a world share of 1% in the 1970s to an insignificant level, and gold production facilities had closed down by the late 1970s[7]; and Mozambique where the Manica Province boasts of some 40 abandoned gold mines, and production at the State-owned Moatize Colliery declined from a peak of 600,00 - 800,000 tonnes per year to 693 tonnes in 1993. Also in Mozambique, a 200,000 tonnes per month copper mine belonging to the State enterprise, Companhia de Desenvovimento Mineiro (CDM) closed down in 1990 (12).

Hindsight has now shown that State control of the mineral industry and the macro-economic environment in which it was rooted relegated mineral development to the public sector which had no capacity for such development. The World Bank (1) further notes:

> The bulk of Africa's mining growth in the past 30 years has taken place in privately-operated mines..From 1960 to 1989, the value of production and exports from privately-operated mines increased by nearly 350%..By comparison, Africa's declining market share for several minerals has in a

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6 It is estimated that in 1996, Zambia Consolidated Copper Mines (ZCCM) required about US$ 2 billion over a period of 15 years to restore production capacity (10).

7 The last major gold mine, Buckreef, belonged to the State Mining Corporation and was closed down in the early 1980s.

> large part reflected the lacklustre performance of state controlled mines (predominantly copper production) where the value of mineral production and exports increased by only about 36%. It must be emphasised that the definition of control...refers to whether the state took a passive role ...or took control and managed the operations through a State-owned parastatal mining company.

Within southern Africa, the value of mineral production and exports increased in those countries where the mines were managed by the private mining corporations, irrespective of the absolute ownership[8]. These include: Botswana where the value of diamond production increased by 374% between 1985 and 1994 (13); Namibia, where it increased by 231% between 1986 and 1993 (14); South Africa where the total value of mineral exports rose by 162% between 1985 and 1993 and Zimbabwe where the total value of mineral production increased by 252% between 1989 and 1993 (16).

The under-performance of the state-owned mining companies, coupled with the political reforms which have swept much of southern Africa[9] have combined to bring about fundamental changes in Government policy and attitudes to the private sector. Thus in virtually all southern African countries, Governments now see their main role as supervising and regulating the sector to promote private investment. Where Government participates in mining investment, its role has been reduced to joint-ventures with the private sector partner providing organisational and management direction. These fundamental changes have been underpinned by liberal reform in the mining codes of most countries in the subregion. The more notable changes have hinged on attractive and

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[8] In Namibia, the industry is 100% privately-owned with the exception of NAMDEB, which is an equal equity joint-venture partner between Government and De Beers Centenary. In Botswana, the diamond (Debswana) and copper-nickel (Bamangwato Consolidated Limited, BCL) mines are also equal equity joint ventures between the private sector and Government. In South Africa, mineral production is undertaken by the private sector while in Zimbabwe the major part of production is contributed by the private sector with only a small proportion from the Zimbabwe Mining Development Corporation (ZMDC). In all cases, except for ZMDC, management of the mines is in the hands of the private sector.

[9] During the period 1991 - 1995, democratic elections were held in Angola, Malawi, Mozambique, South Africa, Tanzania and Zambia.

often negotiable tax-based incentives, guarantees against state expropriation, security of tenure and the privatisation of the state equity in parastatal mining companies.

The changes in the legislative and fiscal policies have directly led to renewed private sector interest in mining projects not only in the subregion but in sub-saharan Africa as a whole. Evidence for this lies in increased private sector based exploration budgets. Frank Gregory, JCI's general manager for geology, recently told an investment mining conference in Johannesburg (17):

> Africa this year (1996) could displace Canada to become the world's third largest destination for exploration expenditure after Latin America and Australia...exploration spending in the region last year (1995) climbed by 60% to US$ 322 million.

Significantly, South African major mining corporations are increasingly spending less money in South Africa, which is historically well-explored, and more outside of it. In 1991, Anglo American Corporation's (AAC) exploration budget for Africa outside South Africa was only US$ 0.1 million. This has grown to US$ 58 million for the 1996/97 financial year. Similarly, less than 10 years ago Gencor was spending 80% of its budget in South Africa. The company now spends some 88% of a much bigger budget outside South Africa. Table 4 shows that the main focus of this exploration effort is gold, diamonds and base metals. Examples of on-going exploration activities by South African companies in the subregion include: gold in Angola, Mozambique, South Africa and Tanzania by the AAC group; diamonds in Angola, Botswana, Namibia, South Africa and Tanzania by the AAC/De Beers group; platinum in Zimbabwe by the AAC group; lead and copper/gold exploration in Namibia and Zambia by Gold Fields and Gencor, respectively; and titanium mineral sands in Mozambique by Gencor (20,21,22).

Clearly therefore, South African mining companies are looking at the subregion with renewed interest. Significantly, however, Table 4 also shows that this interest is much further afield than the subregion. West Africa, Latin America and South East Asia are

Table 4: Geographical distribution of exploration activities by several South African mining corporations

Mineral Type	Anglo American Corp.	Gencor	Gold Fields
Gold	Anglo, Argentina, Burkina Faso, Mali, Mozambique, South Africa, Tanzania, Ivory Coast, Ghana, Kenya	Argentina, CIS, Brazil, Equador, Ghana, Indonesia, turkey, Mexico, Kenya, Tanzania, Dominican Republic, Burkina Faso, Ivory Coast	Ghana, Equador, Bolivia, Venezuela, South Africa
Base Metals: Copper, Cobalt, Lead, Nickel, Zinc	Chile, Peru, South Africa, Venezuela, Brazil, Ireland	South Africa, Canada, Chile, Peru, Equador, Mexico, Indonesia, Zambia, Australia	South Africa, Namibia
Diamonds	Angola, Botswana, Namibia, Canada, Brazil, Tanzania, China, South Africa	-	South Africa
Platinum	Zimbabwe	-	-
Coal	-	Australia	-
Bauxite, Alumina	-	Brazil, Australia, Suriname	-
Titanium mineral sands	-	Mozambique	-

Source: Company annual Reports, 1996 (20,21,22)

major areas of exploration activities by South African Corporations. Given this geographical spread, to what extent can South African corporations provide the initiative[10] for mine development in the subregion?

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[10] South African mining corporations are not the only active exploration companies in southern Africa. BHP of Australia is active in Mozambique, Namibia, Tanzania, and Zimbabwe. The larger population of exploration companies are Canadian junior companies who are active in Angola, Botswana, Malawi, Namibia, South Africa, Tanzania, Zambia and Zimbabwe. In Zimbabwe one of the most active exploration country in the region, there were 14 Canadian mining companies active in August 1995. The ECA/MULPOC report (12) and Chamber of Mines Journal (17) give more details of the current exploration activities in the subregion.

3.1.2 A Closer Look at South Africa's Potential in Mobilising Risk Capital

It must be understood that South Africa's mineral industry is unique and very different from those of other large mineral producing countries. In South Africa, the mining industry is dominated by six major mining groups, namely: Anglo-American Corporation and the De Beers group, Anglovaal, Gencor, Gold Fields of South Africa, Barlow Rand and the Johannesburg Consolidated Investments (JCI). The group system has traditionally revolved around mining finance houses, each administering a number of mines and other group companies. Although each company within the group is autonomous, the group provides them with technical, financial and other support services (5,18,19).

The mining house group system has been very successful in mobilising large exploration and mine development finance in South Africa[11] due to an exceptional concentration of capital in the hands of a few corporations. Reports (19) indicate that the four main groups of the above companies control as much as 80% of the value of shares on the Johannesburg Stock Market, which by way of comparison is the 10th biggest in the world. Furthermore, the concentration of capital is sharpened by extensive cross shareholding[12] among practically all the major mining corporations. According to Jourdan (19):

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11 The mining house finance system is irrelevant to small and medium scale mining as the major corporations have little interest in small projects.

12 In 1996, the AAC group had shares in Gencor Ltd, Gold Fields and Randgold. In 1995, the AAC group also owned 39.7% of JCI Company Ltd which was restructured the same year into Anglo American Platinum Corporation Ltd (35% owned by the AAC group), JCI Limited (39.7% owned by the AAC group) and Johnnies Industrial Corporation Ltd (39.2% owned by the AAC group). The AAC group also owns 29.4% of De Beers Centenary AG. On its part, Gencor holds a 27% stake in Anglovaal and 14% of Rand Mines Ltd. In financial services, AAC also owns 25.4% of South African Eagle Insurance Company Ltd, 20.4% in First National Bank, 40.1% of the Southern African Life Association Ltd, and 100% in Consolidated Share Registrars Ltd, a share transfer company. It is clear that the cross shareholding results in a number of permutations spanning all sectors including mining, commerce, industry, banking and services.

> the overall concentration of capital in South Africa, particularly in the AAC-De beers group, is probably the highest for any capitalist country and if anti-trust legislation was copied from either USA or Britain, it would result in the break-up of most large mining houses.

Quite clearly, the capacity to mobilise large amounts of domestic capital through the mining finance house system is there. This may be exemplified by the new Columbus Stainless Steel Plant, a R3.5 billion project to manufacture stainless steel, owned by Gencor and Anglo American and which was commissioned in 1996. It is doubtful, however, that this domestic capacity can be extended to finance off-shore projects in the subregion.

There are two major reasons for this scepticism. Firstly, South Africa's current macro-economic scenario is characterised by high volatility in the currency and bond markets since the scrapping of the financial rand in 1995. The instability in South Africa's financial markets has been exacerbated by: a large and growing public sector debt, which in 1995 was about US$ 61 billion[13]; exchange controls to limit the outflow of capital and a growing inflation rate. These factors provide a brake on large scale domestic borrowing to finance off-shore investment in mining projects. Secondly, with previous political pressure on South Africa, the major mining corporations found it necessary to move offshore funding activities to subsidiaries and associate companies outside South Africa to finance off-shore exploration and mine development. In the case of Anglo American Corporation, the non-diamond interests in Africa, located in Botswana, Mozambique, Zambia and Zimbabwe are held by ARH Limited S.A. incorporated in Luxembourg, which together with Amgold, hold 45.6% shares in Minorco, the international arm of AAC (20). Similarly, Gencor owns Billiton International (BVI), the repository of its international interests (21).

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[13] The 25% (US$ 12.5 billion) increase in the public sector debt in 1994 arose from costs of absorbing the previous homelands, borrowing to reduce the deficit in civil service pension funds, and borrowings to finance foreign exchange losses incurred from subsidising imports (23).

Offshore subsidiaries, which are listed internationally, have enabled South African Corporations to significantly expand their global mining interests. Table 5 shows that the current mining activities of the corporations cover Europe, North America, Latin America, the Pacific Rim and, more recently, West Africa. Offshore financing has been further strengthened by the return of the Corporations to the global capital markets. For example, Anglo has recently syndicated a five-year US$ 1 billion multi-currency credit facility to take advantage of any mineral opportunity that arise in and outside South Africa (20).

Table 5: Geographical coverage of current mining and processing operations for several South African Corporations

Mineral/Metal	Anglo American Corp.	Gencor	Gold Fields
Gold	Ghana, Brazil, Canada, Namibia, USA, South Africa	Ghana, Canada, Brazil, Mexico, Indonesia, South Africa	Ghana, South Africa
Base metals: copper, cobalt, nickel, lead, zinc	Botswana, Canada, Chile, Zimbabwe, South Africa, Zambia	Canada, Columbia	South Africa, Namibia
Diamonds	Botswana, Namibia, South Africa	-	South Africa
Platinum	South Africa, Zimbabwe	South Africa	
Ferrochrome	Zimbabwe, South Africa	South Africa	
Ferro-manganese	South Africa	South Africa	
Aluminium/Alumina	-	Brazil, Australia, Suriname, South Africa	
Titanium minerals	South Africa	South Africa	
Coal	Botswana, South Africa	South Africa	South Africa
Industrial Minerals	Botswana, Brazil, Germany, Spain, UK, Zimbabwe, South Africa		
Vanadium	South Africa	-	-

Source: Company annual reports, 1996 (20, 21, 22)

The above considerations suggest that financing the increased exploration and mine development expenditure in the subregion is unlikely to be from South Africa's internal resources, at least in the short term. It is most likely to come from the ability of the corporations to raise funds from the international money markets. A more important observation, however, is that South African mining corporations have increasingly considered mining investment on a global basis. The lesson from this is that mining opportunities in southern Africa must globally compete for finance, irrespective of whether the projects are financed by South African mining corporations.

3.2 R & D and Technological Capacity in the Mining Industry

Technological capacity[14] is a necessary precondition to managing a globally competitive industry. Generally, capacity is premised on two issues: the presence of functioning research and development institutions and the availability of skilled manpower. The issue of R & D is addressed below while that of skilled manpower is presented in section 3.3.

3.2.1 The State of Research Facilities in Southern Africa

Ordinarily, there are four potential sources of R&D products available to the mining industry. These are: geological surveys and other government departments; publicly-funded mining research bodies; universities and the mining corporations themselves.

Outside South Africa, there are very few functioning research institutions in southern Africa. In most countries, geological

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[14] Theodore Jay Gordon (24) lists the following main components of technological capacity:

a. to what extent can the country contribute to the generation of new knowledge, inventions and innovations?
b. to what extent is it a source of new technology for others?
c. to what extent can it cover its own technological needs by its own R&D activities?
d. how efficiently can it assimilate and use imported technology?
e. how efficiently can it manage the socio-economic consequences of technological change?

surveys and geology departments are the only active mineral resources development agencies. Their general condition is that they are under-funded and lack both human and equipment resources to undertake the field work necessary to the process of building up the information base for mine development. Through bilateral and multilateral aid programmes[15], some capacities have slowly been established, particularly in the areas of digitising and re-interpretation of previous geophysical data, strengthening data management and indexing information so that it is available to the potential investor in on-line digital form or CD-ROM. How much of this is creating a long-term capacity is a matter of debate due to an absence of many elements contingent to maintaining capacities.

Besides geological surveys, government departments, or publicly funded institutes, dedicated to mining and metallurgical research are largely absent. The only exception is in Zimbabwe where the Department of Metallurgy and the Institute of Mining Research (IMR) are both funded by the Ministry of Mines. The Department of Metallurgy undertakes laboratory and pilot scale metallurgical research, notably in process testing, evaluation and optimisation. The IMR has good facilities in economic geology, applied mineralogy, rock mechanics, metallurgy and there is a coal laboratory. The IMR has also been developing a data base on the subregional mining industry. Although the institute offers contract work for the large mining corporations, their biggest impact is in supporting small scale and artisanal mining activities. However, the capability of both the IMR and the Government Laboratory is seriously handicapped by funding constraints and they both need to replace their aging equipment.

Departments of mining and metallurgy are much fewer than those in geology in southern African universities. Mining departments are only available at the Universities of Luanda, Zambia and Zimbabwe. Mineral processing and metallurgy departments are present only in Zambia and Zimbabwe. As with the other government-funded

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15 Virtually all countries in southern Africa have benefited from such assistance programmes. The capacities created at the geological surveys and university geology departments in Botswana, Namibia, Tanzania and Zimbabwe are notable.

institutions, finances are a major factor resulting in a lack of research equipment and journals. Despite the shortcomings, there is a good capability in computer-based mine planning at the Mining Department in Zimbabwe. In mineral processing, the research efforts of the University of Zambia are also notable.

Outside South Africa, there are no significant company-based research facilities. Zambia Consolidated Copper Mines (ZCCM) have in-house research facilities to support their mining and processing operations. The technological capacity of the facilities is, however, limited. The lack of functioning R&D facilities in much of southern Africa has created a long term dependence on external sources to keep the mining industries functioning.

3.2.2 South Africa's Capacity in R&D and Mining Technology

The South African mining industry is underpinned by a significantly globally competitive capacity for mineral-based research. This capacity has evolved over the most part of this century in direct response to the challenges posed by the need to treat mineralogically complex low grade ores and the progressively harsh conditions arising from deep level mining[16]. The development of South Africa's R&D expertise owes much to a proliferation of world class mineral-based research centres. These include universities, autonomous state-funded institutes and facilities belonging to the mining corporations.

Much of the geological research is undertaken by the Council for Geoscience and geology departments in a number of universities, notably at the universities of Pretoria and Witwatersrand. South Africa has built up a good geological, geophysical and geochemical knowledge base in the form of memoires, handbooks, research papers and maps, most of which is available in digital format. The Council

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[16] The complex mineralogy of some South African ores is typified by the copper-uranium-phosphate deposit at Palabora. South Africa has the deepest gold mines in the world many of which are more than 2,000m. This results in high heat levels and rock pressures. Heat stress and rock bursts are, as a result, common in the working environment.

for Geoscience also has an excellent on-line mineral resource data base. This information base, supported by sophisticated mineralogical, petrological, geochemical and isotope facilities, is used by numerous mining companies to reduce their up-front exploration costs and geological risk[17]. In addition, most of the mining corporations have excellent exploration capabilities. A good example is the AAC capability which includes novel geophysical, geochemical and remote sensing capabilities.

Mining technology R&D is undertaken by the Division of Mining (Miningtek) of the Council for Scientific and Industrial Research (CSIR). Miningtek's research focus has traditionally been in rock engineering, mining systems and mechanisation, geophysics and mine environment. Table 6 gives an indication of Miningtek's technological achievements in these areas. Notable are the rapid yielding props installed on various mines, including in Zimbabwe, and the range of instruments for monitoring ground movements and profiling ore bodies. The Mining Department of the University of Witwatersrand also has excellent research facilities for the investigation of rock behaviour in-situ.

Perhaps an area in which South Africa has had the greatest advances is the development of extraction technologies for a wide range of minerals. Most of the advances have come from several metallurgical departments in universities[18], the major mining corporations and, more notably, Mintek[19]. Table 6 gives a summary

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17 It is estimated that exploration risk accounts for up to 61% of the investment risk of exploration companies (18).

18 Notable are the Universities of Pretoria and Witwatersrand. The Metallurgical Department at the University of Pretoria has two national Metallurgical Centres of Expertise. The Centre for Corrosion Engineering undertakes research in the field of metal corrosion while the Centre for Welding Engineering studies the weldability of metals. A third centre in hydro-metallurgy has been planned for sometime (12).

19 Mintek is the national research organisation founded in 1934 to promote domestic process design and technology development in the mineral extraction industries

Table 6: Summary of South African Developed Technologies in Mining and Extraction Metallurgy

Institution	Technological Development	Application	Collaborating Corporations
Miningtek	• MINSIM	Computer programme for design of Mine Layout	
	• Rapid Yield hydraulic props	Control of Rock busters and Rock falls	
	• Cone Bolts	Energy absorbing yielding tendons for tunnel support	
	• PRISM	State-of-art digital seismic monitoring	GENCOR Mining Group
	• Black Box	Monitoring of ground motion	
	• Methane Logger	Design of ventilation layers	SIMRAC
	• Impact Mining System	Non-explosive continuous mining	
	• PLUTO	Radio wave tomography for imaging ore bodies	
	• Gold Analyser	Estimation of gold value values in situ	
Mintek	• Carbon-in-Pulp (CIP) Process	Processing of low grade gold ores eg. from dumps	Chamber of Mines
	• NIMCIX contactor	Continuous ion-exchange recovery of gold	AAC, Vaal Reef, Chamber of Mines
	• Multi-variable control system and • Mill star	Computer-based optimisation of milling circuits using hydrocyclone underflow meter and particle size estimator (PSE)	Goldfields
	• 3CR12	Corrosion resistant alloy used in mining, power, petroleum industries	AAC, Columbus Stainless Steel

Institution	Technological Development	Application	Collaborating Corporations
	Direct Resistance Furnace, Minfurn	Continuous regeneration of carbon	
	Leach, ion exchange and solvent extraction	Recovery of Platinum	USA, Britain, Canada
		Recovery of low grade uranium	Johnson Matthey
	• Bacterial oxidation	Extraction of gold from refractory ores	GENCOR
	• Spangold	Production of harder jewellery gold	
	• Submerged-arc Furnace Control (Mistral)	Computer control of submerged-arc furnaces in ferro-alloy production	Metallays Ltd., Chrome Corp., Middleburg Steel & Alloys Ltd.
	•Plasma Furnace Process	Smelting of fine chromite ore	Samancor, AAC
Atomic Energy Corporation (AEC)	•Molecular Laser Isotope Process	Enrichment of uranium by pulsed laser beams	Industrial Pilot scale evaluation
	• Plasma and Fluorine Process	Upgrading of Zircon to Zirconia by Plasma dissociation	Industrial Pilot Scale Evaluation
<u>Companies</u>			
AAC	• Highfield Process	Beneficiation of Vanadiferous ores	Processing of fine chromite ores
JCI/Samancor	• Pre-reduction Technology	Corex Direct-reduction	Direct iron making
ISCOR			

Source: CSIR: Mining Technology Annual Review 1995/96 (25); Mintek Annual Review, 1996 (26) and the Benefits of Technology Transfer from Mintek to the Minerals Industry (22).

of Mintek's contributions to the global mineral extraction industries (18,26,27). Notable contributions have been made in the areas of:

a. gold extraction in which the carbon-in-pulp (CIP), resin-in-pulp and NIMCIX technologies opened the way to the exploitation of lower grade ores as well as the reprocessing of billions of tonnes of waste dumps from previous mining operations. To date, more than 40 CIP plants are in operation globally and in South Africa, while NIMCIX has been installed at 6 plants[20]. Continuing developments include the bacterial oxidation of refractory gold ores.

b. leach, ion exchange and solvent extraction technology for the extraction of uranium and platinum. Some 27 plants have been built in South Africa to extract uranium from the Witwatersrand ores.

c. submerged-arc furnace control (Minstral) for ferro-alloy production. Minstral has been installed at several plants outside South Africa including at Dunkirk in France and two ferro-alloy producers in Brazil.

d. plasma technology for the smelting of fine chromite ores[21] and new applications in the processing of beach sand minerals at Namakwa in South Africa. AMSA's Loma de Hierro nickel project has also been planning to use Mintek's plasma smelting technology (26).

e. spangold whose licence has been sold to a US company (26).

Outside Mintek, technological innovations have also come from the Atomic Energy Corporation (AEC) who have been investigating the use of molecular laser isotopes for uranium enrichment and plasma processes for the reduction of zircon to zircornia. Notable advances contributed by mining companies include processes for the

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20 In 1996, MINIX was evaluated for possible use at Olympic Dam, one of Australia's largest mining operations (26)

21 The world's largest DC transferred-arc smelter was in 1996 being built for Samancor's chrome direct reduction plant at Middelburg Ferrochrome in South Africa (26).

beneficiation of vanadiferous ores, fine chromites and the world's first Corex direct-reduction plant.

A striking feature of R&D in South Africa is the extensive collaboration which exists between the universities, the state funded research institutes and the mining companies. Practically all the research undertaken in universities is funded by the mining corporations while most of that undertaken by Mintek and Miningtek is contract research on behalf of the mining companies. This interface has enabled the country to build up a high degree of technological transfer from the research institutes to industry. With the increasing globalisation of mining activities by South African mining corporations, the country's technological prowess has increasingly become a leveraging point in off-shore mine development. According to Gencor's 1996 annual report (21):

> The possession by Gencor of a commercially proven, proprietary bacterial oxidation process, BIOX, ...is a valuable asset in the context of Gencor's growth ambitions in gold. BIOX has added value at two of the group's own mines and licences have been granted to a number of third parties who have successfully applied the technology, notably Ashanti Gold mines.

Other opportunities for technology leveraging by Gencor have included (21):

a. BIOX tests for gold extraction in the CIS and at the Pueblo Viejo prospect[22] in the Dominican Republic, in addition to a licence agreement concluded with Minera Lizandro Proano in Peru;

b. a joint-venture with PT Aneka Tambang and QNI Limited which will evaluate nickel and cobalt sulphides in Indonesia using DC arc plasma smelting;

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[22] Eldorado Gold Corporation has been granted the North American Rights to use and sub-licence the BIOX process. Eldorado is a 50:50 joint-venture with Gencor to evaluate the Pueblo sulphide deposits.

c. the pilot plant tests to use Gencor's Biological Leaching Technology at Maggie Hays, a nickel sulphide joint-venture with Forrestania Gold NL in Australia;

d. development of the Moebase titanium minerals sands in Mozambique based on proprietary technology at the Richards Bay Minerals heavy mineral sands plant, a 50% Gencor subsidiary.

Clearly therefore, the ability of South African mining corporations to stay at the leading edge of mining and processing technologies is proving to be the greatest major asset for their global expansion. The benefits to subregional economic integration of such substantial technological muscle cannot be overlooked.

3.2.3 Beneficiation and Value-Added

Beneficiation encompasses several sequential stages of adding value to the mineral product cycle which proceeds through the following stages:

I. ores and concentrates (first saleable products);

II. primary metals (smelter and refined products);

III. alloys and semi-manufactures;

IV. fabricated products. (manufactures)

There are many reasons why beneficiation and value-added products make sense to the subregion. Some of the more compelling ones include the fact that:

a. mining exploits a wasting resource and therefore the benefits over the life of the resource must be maximised;

b. in the long term, the price of primary mineral commodities have been falling in relation to their manufactured products, hence beneficiation improves a nation's trade profile[23];

c. the transport and weight loss advantage to export markets abroad.

Despite these benefits, the mineral industry of southern Africa, including that of South Africa, is integrated into the commodity markets of the economies of developed nations. Most of the southern African mineral economies end at stage II in their beneficiation operations. Zimbabwe and Zambia undertake very limited activities at stage III while stage IV is only significantly present in South Africa. Yet even South Africa earned less than 20% of its total 1993 mineral revenue from domestic sales (15).

A number of reasons are adduced for this paradox[24]. The important ones include:

a. the perception by mining corporations that they are primarily resource companies and that the degree of further beneficiation must fit in with profitability, capacity and global strategy rather than pure national economic benefit[25];

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[23] Jourdan (19) contends that price instability for commodity exports decreases with increased processing. A comparative study of minerals, agricultural materials and foodstuffs showed all three displaying greater stability with increased processing. The biggest change in prices was, however, in minerals.

[24] See Jourdan (19) for a more detailed analysis of the barriers preventing further beneficiation and value-addition to mineral products.

[25] According to its Chairman, Gold Fields has become increasingly focused on mining. Some years ago it closed down its industrial division which was diverting a lot of management's attention (22). Similarly, the 1996 Gencor report (21) states its mission as achieving real growth as one of the world's foremost natural resource groups by owning and managing a major portfolio of strategic holdings in focused, world-class mining and metal businesses, diversified by commodity and country.

b. the large mineral output from the subregion which would preclude beneficiating the entire output as this would increase insecurity among customers. Increased beneficiation often entails competing with customers which may undermine existing (eg marketing) alliances;

c. import tariffs which progressively get higher with increased beneficiation[26];

d. beneficiation projects tend to be capital intensive while domestic fiscal disincentives tend to make the cost of capital and the taxation rate high.

e. high domestic prices of feedstock (mostly refined metals) to the fabrication sector which include the international price (usually LME) plus the cost of transport and any national tariffs.

Despite these obstacles, the popular policy of all southern African countries is to increase the level of local beneficiation and value-added to the highest levels possible. This is not only a case of increased foreign exchange earnings. It is also a question of industrialisation and the promotion of regional economic integration through a production of tradeable goods rather than mineral commodities which are at present not significantly traded in the subregion.

Beneficiation and value-added mineral products are closely linked to technological capacity. Much as it has been illustrated that South Africa possesses world competitive technologies in primary beneficiation (stages I, II to III), technologies for the fabrication (stage IV) are not fully developed. However, there are many positive developments which point to increased domestic

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[26] In the industrialised countries, ores and concentrates are generally duty-free, ferroalloys have low import tariffs (6 - 10%) while import duties for special steels and manufactures are high (10 - 20%). In addition, non-tariff barriers, such as quotas, can be more important than tariff barriers (19).

beneficiation albeit that they broaden the scope of stage III rather than significantly add to stage IV. These include:

a. the mega project at Columbus Stainless Steel joint venture commissioned in 1995 which at full capacity would expand stainless steel production in South Africa to some 400% of 1994 production(18), and the conversion/modernisation of ISCOR's facilities to produce stainless steel;

b. Samancor's joint-ventures: Advalloy (with Japan Metals and Chemicals, JMC Limited and Mitsui) which will be one of the world's largest producers of refined manganese; Poschrome (with Postrade Inc., Posco and Samsung Corporation, all of Korea) which will modernise and expand production of ferrochrome; Crometals (with Nisshin Steel of Japan) for ferrochrome production;

c. the research at AEC to produce zirconia from zircon which should significantly add value to the large output of heavy meal sands;

d. development of new jewellery technology for coloured platinum (platigem) and spangled gold (Spangold) which promises to increase the domestic off-take for these metals.

A major feature of the joint-ventures above is that they involve new imported technologies from the external partners[27]. The Samancor joint-ventures, together with other alliances, will not only bring new technology but will secure markets for over 75% of existing and planned ferrochrome output. The significant lesson for regional economic integration is the capacity of South Africa to acquire and add to external technologies due to its own existing capacities. A further lesson is the importance of technical alliances in the industries, through which products may be

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27 With Advalloy, the Japanese partner, JMC will phase out production of manganese alloys at its Takaoka by 1998 due to escalating costs. Advalloy will inherit this technology.

dissipated. These attributes should add to the technological development of an integrated southern Africa.

3.3 Human Resources Development and the Mining Industry.

The ECA/MULPOC recently undertook a detailed study (12) of the availability and quality of skills and competencies in the mining industries of eastern and southern Africa. Their findings were instructive and revealed a number of weaknesses.

All countries in the subregion, including South Africa faced numerical skill deficiencies of various intensities for a number of skill categories. Furthermore, the skill base in non-mining countries, such as Malawi, was small while the competency levels and technical practice in countries where the state had been the major developer of minerals, including Mozambique, and Tanzania and Zambia, had substantially deteriorated. This was attributed to weak competency definition, and the general lack of industry involvement in skills development[28]. The dynamic mining sectors of Botswana and Namibia relied heavily on expatriate labourforce who occupied jobs requiring strategic leadership skills, but in a number of cases, even technician-level jobs. Table 7 illustrates the skill deficiencies identified by ECA in a number of southern African countries (12).

The ECA report further noted that the unavailability of skills in small scale mining sector was particularly conspicuous[29]. Mining operations were often conducted on an ad-hoc basis by people who hardly understood the technical exigencies of mining as a discipline, with great human and environmental costs. In addition, the specialised skills in mine planning and design, geostatistics and mineral reserve estimations, mineral economics, mineral process and plant design, were all weakly developed with the exception of

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28 The latter does not include Zambia where the mining industry has traditionally sponsored students at universities at home and abroad and provided industry jobs for vacational training.

29 This excludes South Africa which has no significant small scale mining sector

Table 7: Indicative skilled manpower deficiencies in selected countries of southern Africa

Skill Category	Bot	Mal	Moz	Nam	Tanz	SA	Zam	Zim
Professionals								
Min. Eng.	x	xxx	xxx	x	x	x	x	xx
Min. Proc. Eng./met.	x	xx	xxx	xx	xx	x	xx	x
Geologists	x	xxx	x			xx		xx
Chemists	x						x	
Surveyors		xx	xx	x	xxx	xx	x	x
Other Eng/ Scientists	x	xx	xx					xx
Technicians								
Mining		xx	x	x			++	+
Min. Proc./Met.		xx	xxx	x			++	
Geological	xx	xx	x	x	x	xx	xx	xx
Surveying		xx	xx					x
Chem. Lab.	x						x	x
Cartog/D'men				x			+	x
Artisans	x	x	xx	xx			xxx	xx

Source: ECA/MULPOC, 1996(12)

Key: x - Slight deficiency
xx - Reasonable deficiency
xxx - Acute deficiency
Blank - Probably sufficient
+ - Slight surplus
++ - Reasonable surplus
+++ - Major surplus

South Africa and to a lesser extent Zambia and Zimbabwe. In respect of Government administrative skills, the ECA/MULPOC report (12) indicated that capacities for playing a regulatory role in the sector was weak in most countries of the subregion. The lack of administrative skills was in a number of areas which included monitoring mine safety and the environment and implementing mining legislation. Further weaknesses manifested themselves in an inability to provide technical services and economic information to industry, and difficulties in fielding mining lawyers, contract negotiators and mineral tax specialists in countries privatising their mineral sectors.

Table 8 illustrates the demand for skilled manpower in a number of southern African countries taking into account the increased exploration activities in the subregion, the replacement of current manpower arising from natural attrition and the replacement of expatriates. The table shows that over a five year period starting 1996, some 22,600 of various skilled manpower would be required by the indicted countries. Although the major part of the demand distribution is accounted for by South Africa (74%), the table shows the demand distribution being strong in the mining countries notably Botswana, Namibia, Zambia and Zimbabwe. But even in the non-traditionally mining countries, the demand is modest.

Table 8: Estimated demand for skilled manpower in a number of Southern African countries for the period 1996-2001

Skill Category	Bot	Mal	Moz	Nam	Tanz	SA	Zam	Zim	Total	Annual Demand
Professional										
Mining Eng.	38	29	33	95	11	872	90	41	1209	242
Min.Proc.Eng./ Metallurgists	22	13	29	34	3	796	78	56	1031	206
Geologists	34	48	37	66	23	535	75	37	855	171
Chemists	14	2	12	10	5	298	27	23	391	78
Surveyors	11	5	11	8	1	327	67	2	432	86
Other Eng./ Scientists	24	n.a.	49	93	n.a.	1500	186	72	1924	385
Sub Total	143	97	171	306	43	4328	523	231	5842	1168
Technicians										
Mining	34	25	22	15	28	579	-17	81	767	153
Min. Proc./ Metallurgy	22	12	11	24	4	338	-6	25	430	86
Geological	37	23	11	15	9	154	25	2	276	55
Surveying	10	n.a.	9	15	9	159	18	3	223	45
Chem.Lab	13	3	9	13	4	118	12	9	181	36
Cartog./D'men	14	2	11	11	5	337	33	14	427	86
Sub Total	130	65	73	93	59	1685	65	134	2304	461
Artisans	198	n.a.	344	575	n.a.	10613	2350	380	14460	2892
TOTAL	471	162	588	974	102	16626	2938	745	22606	4521

Source: ECA/MULPOC, 1996(12)

In Table 9, the demand distribution has been matched against the estimated annual supply of mining skills in southern Africa. The significant point about table 9 is that the subregion is under-training, particularly in the degree programmes. It is also notable that South Africa is the major source of both degree and non-degree training. At degree level, South Africa accounts for 71% of graduates in the indicated categories, while at technician level, South Africa's portion is some 68%.

Table 9: Estimated output of skilled manpower from Southern African major academic institutes.

Skill Category	Bot	Mal	Moz	Tan	SA	Zam	Zim	Total	Annual Demand
Professional									
Mining Eng.					69	11	15	95	242
Min.Proc.Eng./Met					125	11	15	151	206
Geologists	9	5	5	20	70	5	10	124	171
Sub-Total	9	5	5	20	264	27	40	370	619
Technicians									
Mining	10		?		120	28	15	173	153
Min.Proc./Met					67	23	15	105	86
Geological			?		22	?	?	22	55
Mine Surveying					24	9	8	41	45
Sub-Total	10				233	60	38	341	339
TOTAL	19	5	5	20	497	87	78	711	958

Source: ECA/MULPOC, 1996 (12)

The major reasons for the under-training resides in the distribution of skilled manpower development facilities which is apparent in Table 9. Outside South Africa, facilities for training mining engineers, metallurgical engineers and geologists, and their diploma equivalents, are only available in Zambia and Zimbabwe. The remaining countries have partial facilities, particularly for training geologists, and in one or two cases, mining diplomas[30].

[30] Almost all countries in the subregion have facilities for training geologists. Outside South Africa, Zambia and Zimbabwe, only Angola has facilities for training mining engineers. Facilities for

Although the facilities for skills development are few in the subregion, they are generally grossly under-funded with the exception of those in South Africa, and to a lesser extent, Botswana. The funding constraints have resulted in inadequacies in physical infrastrucure such as buildings and laboratory equipment, and shortages of teaching materials. In some cases, the funding constraints have also led to an exodus of teaching staff due to uncompetitive remuneration.

South Africa's large output of skilled manpower indicated in Table 9 indicates its potential to contribute to human resources development in the subregion. This potential is explained by its many mineral-related academic institutes. At degree level, 2 universities offer training in mining engineering; 6 in metallurgy and/or mineral processing and 7 in geology. At diploma level, four technikons, namely Witwatersrand, SA, Pretoria and Vaal Triangle offer a range of courses. Furthermore, these training institutes are very well integrated with industry, which provides a significant proportion of operational expenditure. Typically, this varies from 60 - 80%. The academic institutes indicated are in addition to company-based training facilities which are common to the major mining corporations[31]. Clearly therefore, the migration of South African mining companies into the subregion present an additional avenue for supporting human resources development if they bring to the subregion their home practices.

A major initiative[32] taking place in South Africa at present is the reform in mining industry qualifications to create unified national competencies between industry and academic-based learning. Education and training in the industry would then be based on

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training mining diplomas are available only in Botswana and Mozambique.

31 Company-based training facilities are also commonly available in the major mining economies of Botswana, Namibia, Zambia and Zimbabwe, but not in the non-traditional mining countries. However, the facilities in South Africa are far more extensive.

32 More details of the initiative can be found in the South Africa country profile in the ECA/MULPOC report (12)

competency-oriented and task-specific learnings modules. This initiative, which is unique to South Africa, has attracted the attention of other southern African mining economies, who have requested SADC to assess how it could be applied in order to develop subregional-wide unified competencies.

South Africa could also contribute much to the development of the specialised skills enumerated earlier and in the development of research-oriented skills due to its high capacity for research as outlined in the previous section. Further areas of skills development facilities unique to South Africa include training in mine environment and safety.

4. APPROACH TO ENHANCING REGIONAL INTEGRATION : THE ISSUES

4.1 Previous and Existing Inter-Linkages

A good starting point for examining the major issues and barriers affecting integration in the mining sector of southern Africa is an assessment of the existing linkages in the industry. Historically, the mining industry in southern Africa has always had extensive inter-linkages webbed around South African corporations.

Table 10 gives an indication of the ownership of some of the major mines in southern Africa outside South Africa. It is clear that South African corporations have a major stake in the mineral industry of the major mining economies of the region. In Botswana and Namibia, South African corporations, particularly the Anglo Group and Gold Fields, are the major investors in practically all mining activities[33]. Despite the nationalisation of the industry in Tanzania and Zambia, the Anglo-De beers Group maintained an interest in Williamson Diamond Mine, Tanzania's current biggest

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[33] The large presence of South African Corporations in Botswana and Namibia owes much to their membership of SACU and the South African financial system of the time. Thus all mine development costs, including exploration, R&D, mine and plant design, engineering and construction did not require off-shore financing.

mine, while in Zambia, Anglo, through its subsidiary, Zambia Copper Investments Limited, has kept alive its interest in ZCCM which has a number of large copper mines. In Zimbabwe, South African corporations are represented by Anglo's interest in Bindura, Zimbabwe Alloys and Zimbabwe Alloys Mines Limited. Notably, however, Zimbabwe's mining industry is far more diversified in terms of ownership. Other major investors include Ashanti (gold), Falconbridge Investments (gold), Falcon Gold (gold), Forbes and Thompson, Rio Tinto Zimbabwe

Table 10: Involvement of South African corporations in mining ventures in southern Africa

Country and Mine/Plant	Mineral of Interest	Shareholding
Botswana		
1. BCL/Selkirk	Copper, Nickel	50% AAC, 50% Govt
2. Morupule Colliery	Coal	100% AAC
3. Botswana Ash	Soda, Salt	16% AECI
4. Debswana	Diamonds	50% DeBeers,50% Govt
Namibia		
1. Tsumeb	Copper, lead	100% Gold Fields
2. Kombat Mine	Copper, lead	100% Gold Fields
3. Tsumeb Smelter	Copper Lead	100% Gold Fields
4. Otijihase	Copper, pyrite	70% Tsumeb Mine, 30% JCI Lt.
5. Rosh Pinah	Zinc, Lead	100% ISCOR
6. Novachab	Gold	70% Erongo Mining and Exploration Co. 20% Metal Mining corp. 10% Rand Mines
7. Namdeb	Diamonds	50% DeBeers, 50% Govt
8. Rossing	Uranium	IDC (Minority)
Tanzania		
Williamson	Diamonds	70% De Beers
Zambia		
ZCCM	Copper, Cobalt	27.3% ZCI, 60.3% Govt
Zimbabwe		
1. Bindura Nickel Corp.	Nickel	AAC
2. Zimbabwe Alloys Ltd.	Ferrochrome	AAC
3. Zimbabwe Alloys Mines Ltd.	Chrome	AAC

Source: ECA/MULPOC, 1996 (12); Ministry of Mines and Energy, Namibia, 1996; Company Annual Reports from AAC Services Annual, Zimbabwe, 1995.

(nickel and gold) Auridiam (diamonds), Union Carbide (gold), BHP and Delta Gold (platinum, nickel and copper), and Lonrho[34] (copper and gold).

The inter-linkages in southern Africa also extend to the supply of equipment and services. Due to the extensive mining sector in South Africa, many foreign equipment suppliers established domestic manufacturing facilities to circumvent the pariah of apartheid. This further added to the local capacity in developing mining technologies. With the re-integration into the global community, South Africa has become one of the world's most predatory suppliers of mining equipment and services.

Table 11 shows a brief overview of equipment and service suppliers from South Africa. It is evident that most of the mining corporations in southern Africa have increasingly sourced their equipment and services from South Africa. This is particularly so for new mine developments such as the Ancuabe Graphite Mine in Mozambique, the Hartley Platinum project in Zimbabwe and the Graftan (graphite and tanzanite) Mine in Tanzania. Equipment and service supplies, however, extend to existing mines in Botswana, Namibia, Tanzania, Zambia and Zimbabwe. Equipment sourced from South Africa has been mainly heavy mining equipment and mineral beneficiation plants while the services have included shaft sinking, project engineering services and feasibility studies.

Other inter-linkages of the mining industry in southern Africa have included the use of skills development and research facilities in South Africa, particularly by Botswana and Namibia and to a lesser extent the other mining economies in the subregion. Limited toll processing arrangements have also been practised. For example, zinc concentrates from Namibia have been sent to South Africa for smelting and refining, while copper/nickel matte from Botswana has been sent to Zimbabwe for refining. These arrangements, however, appear to have been mainly within companies of the same groups.

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[34] Lonrho's mining interest have been the subject of a recent take-over by the AAC group.

Table 11: Illustratory equipment and service suppliers from South Africa in 1995

SA Company	Equipment/Service	Country/Region (mine supplied)
SAECI	• Explosives, Chemicals	• Bot, Zam
Bateman Equipment	• Beneficiation Plant	• Zim (Hartley), Moz (Ancuabe) Tanzania (Graftan)
	• Jack hammers	• Zim (Hartley)
Barlows	• Earthmoving/mining	• Most of Southern Africa
Bell	• Earthmoving/mining	• Zim (Hartley), Tanz (Graftan), Bot (Orapa,Jwanerg), Australia, W/Africa
Davy Int'l	• Beneficiation Plants • Smelting Plants	• Zim (ZIMASCO) • Zim (Hartley)
De Beers Industrial Diamond Division, Debid	• Diamond wire cutting	• Zim (AAC)
Delkor	• Process Equipment	• Zam (ZCCM), Moz, Zim, Chile, Ghana, Venezuela
Dowding Reynard & Associates (DRA)	• DMS Equipment	• Tanz (Williamson), Zim (Auridiam), Nam (CDM), Canada
Metallurgical Design & Management (MDM)	• Beneficiation Plant	• Tanz (Twiga and Graftan), Bot (Monarch), Malawi (Mchenga)
RUL Mining & Contracting	• Shaft Sinking	• Zam (ZCCM), UK, Peru, Chile, Australia

Source: Mining Magazine, 1995 (18)

It is evident that through common ownership of mines, shared sources of equipment, services and training facilities, some "degree" of integration exists in southern Africa. It is necessary to understand, however, that these elements of cooperation and integration have evolved around the exigencies of powerful corporate interests which have not always been in harmony with national aspirations of social equity. This is why the renewed interest in southern Africa by South African mining corporations is raising a number of fundamental issues. One of these is whether:

economic integration in Southern Africa, led by South African mining corporations, should continue in the traditional manner or the nature of the relationship between the state and the corporations should be changed?

4.2 The Diverging Concerns of Governments and the Corporations

4.2.1 The Concerns of Governments

Governments accept that real growth of their respective mining economies can only be provided by mining corporations. They argue, nevertheless, that the current relationship with mining multinationals needs to address a number of critical issues, particularly the role of the mineral sector in stimulating broad economic growth, and the guaranteeing of social equity within the industry. Some of their major concerns in this direction are that:

a. the concentration of capital and existence of monopolies in the industry has given the corporations too much power and resulted in collusive tendencies. A few corporations dominate domestic feedstock prices and this, coupled with the unwillingness by mining corporations to add value to mineral products, has impeded the growth of higher value mineral industries especially through import parity pricing. The monopolistic structures have also promoted tendencies towards transfer-pricing with inevitable diminished income accruing to the State. State intervention is required to check these and other excesses.

b. the power and total dominance of the mining sector by private corporations makes economic integration difficult.

c. South African mining corporations in southern Africa are mere extensions of their head-offices. In Botswana and Namibia, the industry has functioned far more as an enclave with most inputs being sourced from South Africa. All R&D products have also been procured from South Africa. Some framework is required to create local capacities and ensure multiplier effects in national economies.

d. Mining corporations from South Africa have a history of racial preferences in the development of local skills. In Namibia, local skills have not been developed for higher technical and management jobs. The mining companies have traditionally brought in their skills from South Africa. Furthermore, the companies keep at their base a core group of qualified people who they use in their expansionist mine developments. In-company career path development and job mobility, particularly at higher levels, have been the preserve of whites. This has left the industry in southern Africa perpetually dependent on whites who occupy most of the strategic jobs in the industry. In the few cases where blacks have been promoted to strategic jobs, they have inherited far diminished responsibilities. The State has a duty to oversee the empowerment of local people.

e. With the re-entry of South African corporations into the global mining economy, their interests have increasingly shifted to other mining regions, marginalising the subregion. The geographical distribution of exploration and mining operations (presented earlier) merely illustrates this view.

f. In the light of South Africa's overwhelming superiority in practically all aspects of the minerals industry, there can be no equitable subregional integration. Most economies would become mere satellites completely reliant on South Africa for the supply of all mining inputs and skills.

4.2.2 The Concerns of Mining Corporations

The concerns of mining corporations mainly centre around fiscal incentives, legislative framework and administrative inefficiencies. They argue that although the climate for mining investment has improved, southern Africa is still a relatively high risk area and that more needs to be done to alleviate the risk factors. These include:

a. political uncertainties which persist despite improvements in democratic processes. Leadership succession and large

disparities in income and wealth distribution exacerbate the uncertainties. The management of expectations and unionisation (militancy) of labour also need to be addressed. Furthermore, the political risk of one country affects the subregion due to an interdependency on infrastructure (such as energy and railways). Therefore regional stability is a major factor.

b. economic and financial factors which include: the high inflation, interest rates and government deficits resulting in fiscal instability; continuing exchange controls and inefficiencies in the financial systems; poor capital markets and low domestic savings which prevent project partnerships; and the high cost structure of the domestic economies which raises the cost of inputs.

c. the lack of freedom to market own products; insecurity of tenure to mineral rights which prevents resource companies to explore and sell mineral deposits; and the lack of assured and transparent progression to mining rights which creates anxiety after exploration costs have been incurred.

d. administrative uncertainties and inefficiencies which still surround the issuing of exploration and mining licences. This reduces clarity in the object of private sector participation which itself keeps shifting. There is also a reluctance to accept expatriate personnel.

The corporations argue that the above factors add to the high risk profile for southern Africa, than say the Pacific Rim. They have to factor these risks into their investment. As a result, their minimum investment criteria for countries in southern Africa must be weighed against comparatively more attractive investment opportunities elsewhere. Their global expansion must be seen in this light. They are involved in a diminishing resource industry and must keep a pipeline of mineral reserves to ensure their survival, growth and global competitiveness. This business aspect, and the overriding need for higher profits to reward shareholders, are misunderstood by Governments.

Corporations also argue that they are not generally in the fabrication sector. However, if conditions are right, they would invest in the sector. They readily admit that many historical injustices have to be remedied. They point out that corporations evolved around a conservative corporate culture which demanded the highest levels of skills. The system has always been discriminatory but not necessarily in the racial sense. Furthermore, the corporations operated very successfully that way and change therefore has always been slow. Corporations are significant investors in training but feel that basic education remains the responsibility of the state.

4.3 Addressing the Concerns of Governments and the Corporations

The concerns by both governments and the mining corporations suggest that a number of actions will be required to promote economic integration in the subregional mining sector. Despite the existence of monopolies in the industry, it is logical to suggest that:

> nothing should be done to curtail the activities of the mining corporations operating in the subregion. Any actions limiting their operations will simply drive them to other more attractive world mining regions. On the other hand, Governments in the subregion must continue with further improvements in their mining codes to bring them in line with other global mineral producing regions.

Improvements should address the provisions which require administrative decision-making such as the progression from exploration to mining permits, and the fact that mineral rights are not privately-held and cannot therefore be used as business tools. Ironically, even in South Africa where mineral rights are mainly privately-held, there are complaints that the large mining corporations have tied up large tracts of exploration ground. It therefore appears that a more secure fixed-term tenure system, with significantly assured progression to mining rights, is needed. The rights should be surrendered in the event of non-development depending on the reasons why. A retention licence, as is the practice in Namibia, would help.

The codes should also allow the mining corporations to market their mineral products. In Zimbabwe, the State through the Zimbabwe Minerals Marketing Corporation (MMCZ), has traditionally marketed all non-gold metals and minerals. The mining corporations have always argued that in the light of the well-structured metal markets, MMCZ was superfluous, and the issue of transfer pricing did not arise. Current developments[35] suggest that MMCZ may not survive long, or if it does, it would have to become an agent of choice (36).

The argument of import parity pricing must be seen from a business viewpoint. A metal producer should not suffer loss of the opportunity cost of selling at the international LME price. What is relevant is that domestic feedstock prices to the fabrication sector should not include transportation costs to international markets. The way to stimulating domestic beneficiation and value-addition is for:

> Governments to provide sufficient policy incentives to enable mining, or other, corporations establish beneficiation and value-added industries.

Such incentives could be tax-based exemptions, preferential capital write-offs, or diminished input costs. For example, reduced energy tariffs were one of the major reasons why the Columbus Stainless Steel project in South Africa was able to proceed. The increasing idea of Export Processing Zones (EPZ)[36] is useful in this respect.

The overall risk profile of the subregion must be reduced. This raises the interesting question whether the region should have common and unified mining policies. This does not appear feasible because the various minerals require different mineral-specific incentives. Furthermore, different minerals often play different roles in the national economy. Additionally, the member States are at different levels of development so that their requirements for

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35 The new Hartley Platinum Mine negotiated the right to dispose of its mineral products.

36 EPZs have been introduced in Namibia and Zimbabwe.

attracting mining investment are not the same. What appears possible is that:

> Governments should work towards a common policy framework for reducing the subregion's mine investment risk profile.

The framework could take the form of "limit setting" of broad monetary and fiscal policy measures such as focusing on positive interest rates, reducing inflation to specific limits, common levels of taxation, and a low tariff structure. Furthermore, the framework should be based on an informed assessment of factors which impact on competitiveness of the subregion's mining industry relative to the global mineral industry. Within such a framework:

> Governments should increasingly promote the region as a whole unit in their efforts to attract mine investment. This would increase the attraction of subregional investment to the mining corporations.

Mining companies are not averse to Government participation in mining projects as equity partners. Many welcome such participation as long as Government does not interfere in the operational decisions of the joint-venture company. It can therefore be recommended that:

> for projects requiring large investments, Governments could take up equity to add partnership to the project. Such a partnership, including representation on the Boards, increases transparency and reduces many of Governments' apprehensions to mining corporations.

With respect to skills development, the recent joint ECA/MULPOC and SADC meeting on Skill deficiencies in the Mineral Sector of Eastern and Southern Africa came up with a number of recommendations to address the issue. Some of the important ones were that:

a. in the light of the limited facilities for human resources development, there must be cross country provision of training in order to redress the numerical insufficiency of skills in the industry. A subregional register of providers must be

immediately developed. A regional qualification framework should also be investigated.

b. there must be unified accreditation and competency standards in the subregion in order to promote the free mobility of skills across the subregion. A regional qualifications authority would help this.

c. cross-country continuous professional development courses should be developed at several centres in the subregion.

These recommendations should, in the longer term, redress the historical imbalances which arose from preferences in education and training opportunities. In the short term it appears that:

> an injunction is required on the part of mining corporations to deliberately increase the numbers of qualified and competent indigenous people in their corporate career ladders. Such positive discrimination should not, however, impair the operational efficiency of the corporate structures, which would not be the case if skills and competency definition was unified.

These recommendations do not fully address all the concerns raised above. In particular, the issues not addressed are: national economic benefit of the integration process; the notion that integration is retarded by the power and dominance of mining corporations; and the apprehensions arising from South Africa's dominant technological capacity. These issues are addressed in section 4.5.

4.4 Need for an Institutional Framework

It is clear from some of the recommendations above that a subregional framework for their implementation is necessary. During missions, it became evident that the current institutional frameworks both at national and subregional levels were inadequate. At the national level, the capacity of Governments to interface with the powerful mining corporations was weak and the relationship between the two one of suspicion. There is need to:

strengthen Government mining departments to improve their capacities to regulate, promote and monitor the activities of the industry.

Strengthened national administrative structures should contribute to reduced bureaucratic inefficiencies. National capacity building is an area in which the UN family, including ECA and the donor community should strengthen their support.

At the subregional level, the overriding opinion was that the SADC sector coordination approach based on a set of projects was ineffective as the sectors' capacities were tied to those of the host Governments, which in most cases were weak. As a direct result, SADC was perceived as having little management capability. Furthermore, SADC's project procedures were perceived as cumbersome and misaligned to the interests of the private sector, the major engine for the growth of the industry. Most private sector personnel interviewed during missions did not know the role of the SADC Mining Unit or viewed it as a "talk shop".

There is a clear need to strengthen the strategic management capacity of the SADC Mining Unit so that it better responds to the needs of the private sector.

One idea increasingly favoured is that the SADC Mining Unit could be transformed into the SADC Mining Commission, along the same lines as the proposed SADC Energy Commission for the implementation of the Energy Programme of Action. The work programme of the Commission could include:

a. networking to promote information sharing[37] including geological, and commodity-related information.

b. undertaking commodity reviews to facilitate the development of specific minerals in the subregion

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[37] It is worth noting that the SADC Mining Sector already has a home page, based at the Council for Geoscience in South Africa, which provides information on SADC countries. The home page has reportedly 600 visitors per month (28). Thus a good start has been made to information sharing.

c. analyzing the major factors affecting the regional industry to promote its global competitiveness;

d. packaging information on mineral development opportunities with a view to selling the subregion based on its competitive factors of mineral production.

e. mobilising consensus among the private sector and Governments to promote equity in the minerals industry[38]. This should breakdown much of the national scepticism about the benefits of integration.

During missions for this report, a number of people expressed the feeling that the UN family, and ECA in particular, could do much to assist in the above areas. Furthermore, ECA could assist with the peer review of SADC Mining Sector programmes, a practice not in place at present.

There is optimism that within the current SADC restructuring initiatives, these weaknesses may be addressed. For example, the 1996 Executive Secretary's Report states (29):

> We need to debate and agree on whether we are satisfied with the current pace of transition...We should begin to see emphasis shifting from project coordination to the establishment of a regional policy framework conducive to investment and citizen participation in the regional integration process. The Secretariat should focus more on strategic planning and management of the overall process towards community building.

During missions, many people expressed the view that there was need to de-centralise SADC so that it does not become a regional Government. They argued that it was at the sectoral level where there was a greater need to strengthen planning and management skills. A Sectoral Commission, independent of Government weakness in funding and able to recruit competitively, would substantially address these fears.

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[38] The Chambers of Mines of the SADC mining countries have already had several meetings (28). However, more needs to be done to align the SADC programme to the interests of the private sector.

4.5 Integration and Competitive Advantage

This far, reference to competitiveness has been amorphous, avoiding specific meaning. A closer view of competitiveness is necessary to understand the object to be served by subregional economic integration. It is also key to the understanding of the role of mining corporations in integration efforts. A more informed understanding of competitiveness should help explain why a strong South Africa is a pre-requisite to a globally successful southern African mining industry.

Recent thinking on competitive advantage argues that although it is predicated on productivity[39], it is not essentially determined by factor costs, as emphasised by traditional theories of comparative advantage (29). Factor conditions, such as labour costs, capital and natural resources (including minerals), are mere inputs, among others, necessary to compete. Competitive advantage is much more related to how efficiently and effectively factor conditions are exploited. Competitive advantage, based purely on factor costs is vulnerable and unsustainable because lower and better factor costs can easily be created or acquired from other sources[40]. The advantage of factor costs is therefore of a much lower order.

More important, competitive advantage is driven by technological differentiation in a manner which produces constant innovation and improvement. It resides in higher order (advanced) factors such as proprietary technology, research institutes and highly educated people in disciplines specific to the area of competitive advantage. The development of higher order factors demands a history of sustained and cumulative investment both in

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[39] The value of output produced by a unit of labour and capital.

[40] Porter (29) argues that due to low competitor entry barriers, competitive advantage based on labour costs and natural resources creates structures which support average returns on investment specifically because of too many competitors. Most exports from developing economies fall in this category. They are tied down to competing on factor costs and price, and lack the capacity to influence competitive advantage.

personnel and physical facilities which are not easy to replicate. Competitive advantage is created by new and better ways to compete either through technological improvement or better methods of doing things within the corporation's value chain. Innovation creates sustainability by shifting the parameters of competition. Competitive advantage resides with firms or corporations. They are the ones who compete in the international market place. Thus industry, and corporations specifically, are the basic units of national competitive advantage.

National competitive advantage is derived from four determinants (29):

a. factor conditions: nations succeed in industries where they have high quality institutional mechanisms for factor creation and efficient use;

b. related and support industries: these must be present in the domestic economy so that the process of innovation and upgrading is based on a close relationship with corporations. The process of innovation is enhanced if the support industries are in themselves global competitors;

c. corporate strategy, structure and rivalry: this determines the context in which competitive advantage in industry is organised and managed. Vigorous domestic rivalry sharpens the advantage at home and creates pressure to innovate and sell abroad. It also nullifies preferential access to factor costs;

d. the nature and structure of domestic consumption which, if present, can create opportunity for innovation and act as a platform for competing globally.

The role of the nation is to positively influence (and be influenced by) the determinants through policy strategies which promote the global competitive advantage of corporations. Of particular relevance is the "home base" which is the source of skills and technology which underpin competitive advantage. This is where a firm's strategy is set and process technology created and

maintained and is the location of the most productive and advanced skills. The home base is where competitive advantage is created and sustained (29).

Much of what has been discussed, and the recommendations advanced, need to be viewed in the context of a competitive advantage for the mineral industry of southern Africa. For example, the central role of corporations has clear lessons for economic integration in southern Africa:

> It is evident that the capacity and global predatory nature of South African mining corporations and, equipment and service suppliers, are not only beneficial factors to economic integration, they are a pre-requisite to global competitive advantage. This is more significant in the light of the increasing internationalisation of trade terms.

The challenge of economic integration to member States does not lie in curtailing the activities of corporations. It lies in promulgating a policy framework which harnesses the potential of the corporations and equipment suppliers to globally compete. In South Africa for example, "cluster studies"[41] are underway to determine the global competitiveness of the mining and associate industries and how it will be shaped by Government policy. Firm supporters of economic integration in that country argue, quite rightly, that this thinking should be extended to the subregion (31,32,33). Mineral policies in the subregion should act as magnets for cluster formation to support the competitive advantage of the mining industry abroad. The object of economic integration should be to encourage mining corporations, and their associate industries, to view the expanded subregional mineral industry as a "home base". Naturally, Governments should ensure that the policy framework obliges the corporations to actively support the development of higher order skills among all the citizenry.

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[41] Porter (29) contends that national advantage resides as much in industry-related clusters as in the parent industry. The presence of world-class buyer, supplier, and related companies in a nation triggers self-reinforcing benefits in upgrading competitive advantage in a given industry.

The mineral abundance of southern African countries, earlier demonstrated, and the lack of capacity for mining technology, are all manifestations of a profusion of lower order factors. There is a significant absence of the higher order factors crucial to developing global competitiveness in the mining industry. South Africa, on the other hand, has both the lower and higher order factors. Much has been discussed earlier about South Africa's technological capacity in mining, its multiplicity of mineral-based research centres and the innovations which have found application in the global beneficiation industries. These innovations have resulted in technology leveraging by South African mining corporations. Examples of this have been given.

Notwithstanding South Africa's global competitiveness in the mining and beneficiation sectors, not all of its lower order factor costs are of a low cost nature. Probably the most significant of these, and certainly the one of most consequence to the integration of the minerals industry is energy[42]. As indicated earlier, coal is the most significant source of electric energy in South Africa. Although much has been written (19) about the country's low electric energy tariffs, coal derived energy is not comparable to that from hydro-electric sources on a factor cost basis. South Africa has traditionally offered concessionary energy rates to large scale industries (such as the Columbus Project) to lower their relative costs compared to those of international competitors.

South Africa's energy problems are amplified when environmental impacts are factored into energy cost assessments. South Africa's policy in the apartheid era was rooted in energy security and showed little concern for the environment. ESKOM, the South African electricity utility was the world's 4th largest in 1994, with a capacity of some 35,000 MW. It consumed nearly 200 million tonnes of coal in that year (30). The effect of this large coal burning industry is that South Africa, with 0.8% of world population contributes 1.5% to green house gas emissions. Some

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42 Smelting and refining operations are among the most highly energy-intensive operations of any industry.

studies already project a substantial sea level rise, expansion of arid zones and higher frequency of weather extremes such as drought, storms and floods (30). Quite logically therefore, South Africa's new energy policy emphasises environmental sustainability, rather than pure economic factors. Understood in this sense, it becomes clear that:

> Economic integration in southern Africa should provide access to both higher and lower order factors located across borders to promote the global competitive advantage of subregion's minerals industry.

Such a scenario, for examples, envisages a situation where higher level factors of competitiveness (skills and technology) migrate to regions where lower level factors (lower wages, cheap, energy, mineral deposits, abundant water supplies, physical infrastructure) are located. There are signs that this is beginning to happen[43]. The Southern African Stainless Steel Development Association argues that this thinking could lead to the manufacture of domestic stainless steel products (such as kitchenware) being established outside South Africa (31). The significant point is that in this context, subregional economic integration strengthens not only South Africa, but the other member States as well.

This leads to an interesting notion. During missions for this report, the possibility of Mintek becoming a subregional centre of R&D in beneficiation and process technology, was discussed. Among the options considered included: Mintek acting as a focal point for technology transfer in a network of research institutes in the subregion; the training of operators from the subregion at Mintek; and member States contributing to the operational budget of the institute in a co-ownership type of structure.

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[43] Gencor are investigating plans to site a major aluminium refinery in Mozambique, a country without bauxite resources. Presumably, feedstock for the refinery would have to be imported from their off-shore subsidiaries. They state that the viability of the plant would depend on a reliable and favourable supply of power (21). Needless to say, this is related to an abundance of hydro-electric energy in Mozambique.

Opinions were interestingly divided. Several Government officials felt that national R&D capabilities were needed to safeguard national interest, although Mintek could be of use to them. Most people from industry supported the idea but largely felt that governments should not have a major role in the operations of a subregional-type of Mintek. Mintek needed more industry-attuned workers who could aggressively plan for the growth of the mining sector. The involvement of a federated Chamber of Mines or an independent Commission for mineral development would be a step in the right direction.

It is the contention of this report that technological innovation is central to the competitiveness of the mining industry in southern Africa. The reality is that none of the subregional countries (with South Africa's exception) has, in the short term, the capability or capacity to establish world-class research facilities of consequence to competitive advantage. The idea of a subregional Mintek short circuits the long and costly path to building such a major determinant of competitiveness. In this sense the idea is attractive. It can therefore be recommended that:

> fuller consultations be initiated, especially among the major mining countries, who would be the main beneficiaries, to examine the integration of Mintek into the subregion in a manner which takes account of present capacities in the other member States such as those resident in the universities, IMR and ESAMRDC. Networking should be a strong feature of a re-defined Mintek.

The issues raised in this section re-emphasise the need for an institutional framework for promoting regional integration. It is also evident why the fundamental restructuring of SADC must move it into the area of strategic planning and management. Above all, the issues indicate that much more work lies ahead to develop a policy framework which will equitably address the process of economic integration. It is obvious from this report that all stakeholders, including Governments, the mining corporations and the citizenry can be winners from the process.

4.6 South Africa Has Its Own Problems

Although South Africa offers the subregion, and the mining industry in particular, an excellent opportunity to advance subregional economic integration, there are constraints. South Africa has a crisis of expectations created by its Reconstruction and Development Programme (RDP). The RDP is essentially a programme of social upliftment to redress the inequities of the past. Some indication of the enormity of Government responsibilities under the programme may be indicated by the following (23):

a. water resources must be provided to 12 million South Africans who have no access to adequate supplies of water;

b. to meet housing needs of the disadvantaged groups, 300,000 - 360,000 housing units per year are required against an estimated backlog of some 1.4 million units;

c. in education, more than 60,000 classrooms were required in 1995 to accommodate school children;

d. in health, infant mortality rates are 13:1,000 for whites compared to 124:1,000 for blacks. A major clinic building programme has estimated a requirement of 780 clinics to be built in two years.

e. 45% of the population is unemployed or employed in the informal sector.

The transition to democracy has, in the short term, strained the capacity of Government and resources, and created the dilemma of how to deliver on the reform programme at the same time as maintain fiscal and monetary discipline required to promote economic growth. The mining industry particularly argues that three aspects of the plan must be tackled immediately to restore investor confidence: privatisation to provide the funds to reduce the large public sector debt; labour flexibility to increase productivity and the elimination of exchange controls which are curtailing investment (20,22). In the light of persisting currency volatility,

the Central Bank prefers a phased scrapping of the exchange controls to prevent a massive outflow from blocked rand accounts and the sell of bonds by foreign investors worried about the rapid erosion of their investment (20,34).

Notwithstanding South Africa's many problems, the major one is seen as the freeing of exchange rates. This should give impetus to subregion economic integration efforts through the cross border movement of factors of production. Available reports (35) indicate that in the interim, the Central Bank has opened a special facility to promote investment in southern Africa in the light of continuing controls. This would be a step in the direction of economic integration.

4.7 Cooperation and Integration Based on Mineral-Specific Projects

The large mineral endowment of southern Africa suggests that the subregion is going to increasingly be a major player in the world mineral industry in the foreseeable future. An interesting question which arises is which minerals hold the best prospects for enhancing cooperation in the subregion and what form is this cooperation likely to take?

It is important to understand that mineral development in southern Africa is going to proceed much along the broad framework advanced in this report. Firstly, that the major developers of mineral resources are going to be the private sector, with the passive participation of the state in a few cases, particularly where the investment outlay may be substantial and government participation provides some longer term security to the project. Secondly, mining projects are going to follow the best opportunities in terms of factor conditions to take advantage of the least cost factors to enhance competitiveness of the projects. Thus it is the need to produce the least-cost mix of factor conditions which is going to drive cooperation and integration. There is much evidence that this is already happening as will be evident from the examples given below.

There are two broad areas in which cooperation is going to be significant. The first is where the subregion's comparative mineral resource potential is large in world terms and there is a possibility of large scale operations which can support long term operations and a significant world market segment. Examples in this category include iron and steel, titanium and zircon containing heavy mineral sands, ferro-chrome, ferro-manganese and platinum. The second category is minerals in which the comparative resource potential may not be high but the minerals are necessary to support existing mining infrastructure. This group comprise mainly the base metals nickel, copper, cobalt, lead and zinc.

4.7.1 Large Scale Mining Projects

A typical large scale cooperative mining venture is the iron ore project currently under feasibility to produce hot briquetted iron (HBI) on the Zimbabwe-Mozambique border along the Beira corridor (37). The project, which is estimated to cost some US $660 million, has been conceived as a joint venture between the Governments of Mozambique and Zimbabwe, South Africa's JCI Limited and the US energy company, Arco. The project will produce an estimated two million tons of iron briquettes based on Zimbabwe's iron ore reserves south of Kwekwe which will be mined by companies Bucha Iron Mining (Bimco) and JCI. The gas required for reduction of the iron ore will be supplied from natural gas resources at the Temane field in Mozambique. The briquettes will be targeted at the under-supplied mini steel mills in the Pacific Rim, where currently premium scrap is used to produce high quality steel for uses such as the manufacture of automotive panels. HBI is used as an alterative to scrap whose prices have risen significantly on account of shortages. Much less known is the fact that there are serious shortages in the mini steel mills in eastern and southern Africa (especially in Kenya) and that the project therefore promises to be of significance to the operations of the subregional steel industry.

With respect to heavy mineral sands, which are the main sources of rutile, ilmenite and zircon for the paint industry, future production favours southern Africa due to its large

comparative potential. The current major producer of these minerals is Australia where production is expected to go into decline in the next five years while a number of new southern African producers have either come on stream or will do so in the next few years. The (potential) new comers in the subregion include (98):

a. Namakwa Sands which began production in 1995 in South Africa in 1995 and will more than double its output by the year 2000;

b. the Iscor Heavy Minerals Project expected to reach full production by the year 2000 from reserves in KwaZulu, Natal, in South Africa;

c. Mozambique where Gencor is undertaking a feasibility for a US $450 million mineral sands project at Moebase and full production is expected around 2003. Kenmere Resources and BHP Minerals have also signed a joint-venture agreement to exploit the Congolone deposit with a mine start-up date scheduled for the year 2000;

d. a new major titanium find off the Kenyan coast some 100 km from the port of Mombasa where Tiomin Resources of Canada has commissioned a pre-feasibility study.

Table 12 gives an indication of the significance of new zircon supply sources in the next five years taking into account developments in Australia and the USA, the only other potential new sources of zircon (38). Richards Bay Minerals of South Africa are currently the world's single largest producer of titanium slag. The company provides 28% of the world's titanium dioxide, 28% of rutile and 31% of zircon. The development of new zircon and titanium sources in the subregion will therefore substantially increase the region's share of world output of titanium and zircon.

An interesting dimension to these projects is the issue of increased beneficiation and value-added products. Tioxide, a joint-venture between South Africa's SAECI and US-based Tioxide, is the only producer of titanium dioxide in southern Africa. The company has recently upgraded its production facility to increase output by

30%. Coupled with the pilot scale trials to produce zirconia from zircon at the AEC (mentioned earlier), value-addition to titanium minerals to heavy mineral sands is likely to increase although it will not divert a significant proportion of output due to the large output in the subregion.

Table 12: Potential new zircon supply 1997-2003

Year		Additional tonnage	Total tonnage
1997	Beenup (Australia)	20,000	20,000
1998	Old Hickory (USA) Namakwa Sands (SA)	30,000 6,000	30,000 64,000
1999	Namakwa Sands (SA) Iscor Heavy Minerals (SA)	39,000 10,000	103,000 10,000
2000	Namakwa Sands (SA) Iscor Heavy Minerals (SA) Kenmare/BHP (Mozambique)	30,000 25,000 35,000	133,000 35,000 35,000
2003	Gencor (Mozambique)	42,000	42,000

Source: African Mining (38), 1997.

Other examples of large projects based on the exceptional resource endowment of southern Africa include the Columbus Stainless Steel and ISCOR projects mentioned in section 3.2.3. The projects will expand the production of stainless steel based on chrome, iron and nickel resources. Projects to expand the ferro-manganese output have also been described in section 3.2.3, while the platinum projects being undertaken in Zimbabwe have been illustrated in section 2.2.

The major points to note about these large scale projects is that cooperation is likely to be based on several factors:

a. diversified share holding portfolio due to the large capital outlay required to bring them into fruition;

b. use of those proprietary technologies, such as plasma smelting technology for making titania slag, in which South Africa has become a world leader;

c. use of existing public and private sector-based facilities for process and mine design work, plant design and construction;

d. use of human resources development facilities, particularly in-company training facilities, to develop skills required for the new cross-border joint ventures.

e. benefits from cheap factor costs, particularly energy.

The essence of the last point is well captured by Dr Ian McRae, former Chief Executive of Eskom (40):

> ..the greatest thing that happened to southern Africa ... during the past few years was the formation of the Southern African Power Pool (SAPP). SAPP allowed for the trading of electricity under agreed rules...there must be a clear understanding of interdependence.. I do not believe that any one country in southern Africa can be strong on its own as we can as an economic community of countries...it (SAPP) is where countries are coming together and looking at the region as a whole on an integrated basis.

4.7.2 Projects to Support Existing Mining Infrastructure

Perhaps it is in the area of base metal extraction and beneficiation plants where a greater degree of cooperation and integration is required. Traditionally, there has been little coordination between the extraction and higher order beneficiation industries. For example, the new Columbus Stainless Steel plant has since 1996 supplemented local nickel supplies with imports mainly from Russia (41). Within the subregion, the bulk of nickel matte from BCL in Botswana is refined at the Falconbridge refinery at Kristiansand in Norway with only a fraction of the output sent to the under-utilised refinery at the Bindura Nickel Corporation in Zimbabwe. Ironically, Anglo is a shareholder in Samancor, BCL and Bindura. In Tanzania, the nickel deposit at Kabanga also seems likely to be developed in the short term (39).

Namibian zinc is transported to South Africa to be smelted at Black Mountain. A new zinc Mine at Skorpion in Namibia looks likely but will produce zinc metal on site to avoid, what the potential developers, term costly third party smelting and refining. The copper and lead smelters at Tsumeb face closure due to the exhaustion of ore at Tsumeb Mine. Spare capacity therefore exists at the two smelters where custom smelting is favoured by a rail link to Walvis Bay. Some copper concentrates (6,000 t) from Black Mountain in South Africa are sent to Tsumeb while a substantial amount is exported to Japan. Meanwhile, Ookiep Smelter in South Africa is under-utilised, presumably due to its remoteness, because its ore sources at Carolusburg and Nigrumoep are nearly exhausted. A small amount of copper concentrates (about 7,000 t) at Ookiep are sourced from Palabora.

The major source of refined copper in South Africa is Palabora. 80% of the production (of some 110,000 t) is consumed internally in South Africa. The current open pit at Palabora will close in 2002 after which the operation will go underground. The Copper Development Association's forecast is that South Africa, the major copper consumer in the region, will go into a deficit demand position in 2003 (42). Meanwhile, there are a number of existing and potential copper sources which include:

a. Zambia where the decline in copper production is likely to be arrested (production will probably increase) following the impending privatisation of ZCCM and the significant exploration activities (12);

b. Habib, in Namibia, where a feasibility study is being undertaken Haib for a large copper project (12);

c. New copper capacity at Sanyati in Zimbabwe which exports its copper products.

d. increased copper output from the new platinum capacities.

Clearly the current situation in the base metal sector is chaotic. There is need to examine the existing base metal

facilities and the potential new sources and match this with the demand and supply situation in the subregion. The assessment should take into account the realisable cost of toll treatment at present facilities taking into account the entire base metal product cycle (ore, concentrates, blister and refined metal). This would optimise existing facilities and ensure that lower order products (eg concentrates) are not exported when existing higher order facilities (smelters and refineries) are closing down. The Copper Development Association further suggests that in the light of the Southern African Power Pool, and the increased consumption of power cable, the copper sector should integrate further upstream (42). They consequently recommend that the electricity utility companies in the subregion should meet with the producers of cable and copper rod to enhance the process of cooperation and integration. In South Africa, cluster studies are being undertaken for the non-ferrous metals industries. The Copper Development Association argue that these should be extended to the southern African region.

The above examples further re-emphasise the strategic direction in which cooperation and integration should be proceeding. The comments also underscore the need for a subregional framework and the nature of the work it could perform.

5.0 CONCLUSIONS

Economic integration in southern Africa can succeed. However, it must be understood that it has to be based on an enduring partnership between the governments and the mining corporations. The partnership will be driven by the efficient exploitation of both the lower level factor conditions (such as abundance and distribution of mineral resources, and energy sources), and the higher order factors (such as resident technological capacity, research institutes, and mineral-based academic facilities). This is going to need a subregional framework which recognises the respective roles of the Governments and mining corporations in such a way that synergy is guaranteed and the global competitiveness of the corporations enhanced. None of the stakeholders, including Governments, mining corporations and the citizenry need be losers from the integration process.

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