

STRATEGIC MINERAL RESOURCES AMONG IBSA COUNTRIES: PARTNERSHIP AND CHALLENGES

Gayettri Dixit*

ABSTRACT

This paper attempt critical analysis of Strategic minerals with the specific reference to India, Brazil and South Africa. It also aims to highlight the huge potential of IBSA cooperation in strategic minerals and the energy sector. IBSA countries have intensified their defence industry collaboration with each member of the triangle to develop some state of the art defence technologies and products. In this paper, the role of India-Brazil-South Africa (IBSA) Dialogue Forum will be analysed from the perspective of their mineral and energy policy.

Keywords: Defence Resources, Energy Resources, IBSA, Industry Resource, Strategic Mineral Resources.

INTRODUCTION

Human progress throughout the ages involves his mastery over mineral resources and their efficient use. The uses of minerals have undergone a major transformation in the last few decades. The emergence of cutting-edge technology every fortnight has further led to a stress build-up on the stockpile of global mineral resources. The political turmoil of the first decade of the 21st century has been marked with civil disturbances, local unrest and inter-state anxieties. Such exigencies create a pull-effect on the mineral resources of the world. In recent time, concern on possible scarcity of natural resources has mounted. The essential concerns have mostly remained the same in the past decades, focusing on the potential impact of accidental or intentional supply disruptions to the economy as far as its dependency upon certain imported materials is concerned. The continuous strife in different parts of the world has led to the exhaustion of minerals and metals used up in munitions and destructive operations. The magnitude is so great that several minerals and metals have reached almost exhaustion point.

*Gayettri Dixit has been awarded Ph.D. by the Centre for African Studies, JNU for her thesis, '*Challenges to South Africa, India, Brazil Partnership in Strategic Mineral Resources*'. Her M. Phil. research was on '*Geographical Importance and Interest of South Africa in Southern African Development Community*' at the same centre. She has done Masters in Geography as well as in Economics.

Mineral resources in respect of specific raw materials have fluctuated significantly with market circumstances. Moreover, the sets of raw materials thought by certain countries to be critical have changed over time. In this paper, we are going to examine the current strategic minerals. The Strategic minerals are usually defined as those minerals that are paramount to the national security of a country but have to be obtained largely or entirely from foreign sources because the supplies available within the country concerned would not be adequate in a time of national emergency (Saxena, 2001:315).

The varieties of minerals that are essential for defence, aerospace industry, energy supplies and transport have at particular times, been listed as of strategic importance. During the Second World War, chromium and tin-bearing minerals, quartz crystals and sheet mica were among the minerals placed in this category. A.A. Archer (1981) from the Institute of Geological Sciences in London has stated that "some minerals are more important, vital, essential or critical than others because they make a demonstratively greater contribution to the national well-being, so that interruption or cessation of supplies, from whatever source, would have greater consequences." This 'criticality' or 'strategic' implication of minerals is directly related to their use (Rae Weston, 1984). The three guiding principles of this concept are: (i) Essential use for national defence, (ii) Essential use for industry and civilian, and (iii) Lack of suitable substitutes. Butt and Thomas (1986) explain that the Strategic minerals are those minerals considered to be essential to critical civilian and military needs in quantities not available from domestic sources or secure foreign sources and for which short-term substitute are not available. From this definition, one may readily observe that time may alter which minerals are considered strategic. The technological breakthrough in composites or ceramics research may provide an acceptable substitute for cobalt in Jet turbine blades and other critical uses, thereby, removing the mineral from the list of strategic minerals. Discoveries of new deposits of strategic minerals in insecure areas of the globe may have a similar effect. Strategic minerals are necessary across the spectrum of modern technology, from electronics and electrical systems applications, aerospace and defence and the conventional energy industry. Many of the uses overlap and converge in the field of alternative or "green" energy.

Critical and strategic minerals are used in both traditional energy technologies and in emerging technologies. Energy conservation and technologies that enable lower energy use are dependent on critical minerals. Two rare earth elements – Praseodymium and Samarium, along with Scandium, are used in forms of high intensity lighting. Light emitting diodes or LEDs, represent a promising new technology for saving energy (Geological Survey, Colorado). Most of the literature on minerals treats strategic and critical materials more or less synonymously, for the sake of clarity they are not separated in this study. It is evident that 'critical' minerals are those that are vital for the defence and industry of a country; however, a 'strategic' mineral implies that its supply is from a foreign or insecure source (Van Rensburg, 1986: 72). The Strategic and Critical Material Stockpiling Revision Act of 1979 in US mentions, "A common definition of a strategic mineral is a mineral that would be needed to supply the military, industrial and essential civilian needs of the United States during a national emergency" (in Office of Technology Assessment, 1985). This paper uses the terminology 'Strategic Mineral' and 'Critical Mineral' interchangeably.

Identification of Strategic Mineral Resources

The key strategic minerals were identified using the following criteria: a) Criticality, (b) import dependence, (c) concentration of sources and (d) technological, geopolitical and other related factors (Anderson, 1998: 53). The strategic concept of minerals has to consider several factors, some of which are listed below:

Essential use for national defence: Without these materials, the nation’s capacity to defend itself could be seriously jeopardised.

Essential use for Industry: The use of these materials must fill such an important need that without these, industries, which are backbone of the national economy and its military production, will get crippled (Office of Technology Assessment, 1985: 46). Adolph Knoph (1946: 7) classified minerals in three categories: “(1) *Strategic minerals*, which are necessary but cannot be produced within our own country no matter how great the price stimulation; (2) *critical minerals*, which are necessary and can be produced by price stimulation; and (3) *critical minerals*, which are necessary and of which we have an ample supply”.

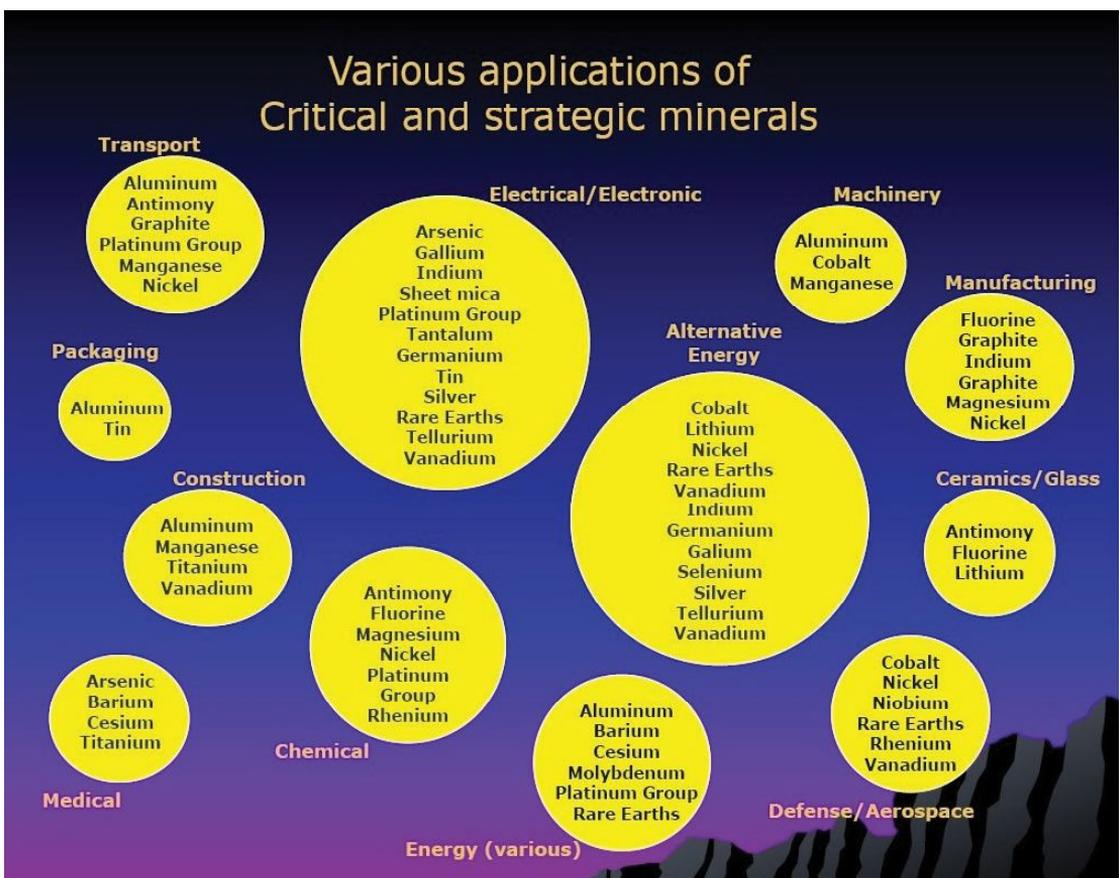


Figure 1: Applications of Critical and Strategic Minerals

Most strategic minerals are chosen in terms of their current and future relevance to the defence planning. Within the defence and aerospace industries many lesser known mineral commodities are important. A number of metals are needed for military equipment, both aircraft and ground based equipment. Vanadium, Rhenium, Cobalt, Nickel and Niobium are all important for special alloys. Various electronic devices for air traffic control, satellite communications and lasers require Neodymium, Samarium, Cobalt, Yttrium, Terbium, Europium, Erbium and others. Because of the need for sophisticated electronics in military applications, all of these materials needed for electronics are also required in aerospace/defence fields.

This paper focuses on three countries namely India-Brazil-South Africa (IBSA). IBSA dialogue forum is a coalition of emerging powers established in the aftermath of global power shifts. Historically, these similarities are rooted in their common experience of colonialism or imperialism and the social and economic inequalities that came with it and got accentuated over time. They also share the status of emerging powers of the South given their growing economic importance and the central role played by their diplomacies in multilateral negotiations.

History of India- Brazil -South Africa (IBSA)

The development of the trilateral India–Brazil–South Africa (IBSA) Forum after the failure of multilateral trade negotiations at Cancun in 2003 represents the emergence of three powerful economies as major stakeholders in the process of globalisation and a common desire to create an institutional framework for South–South co-operation. As the economic leaders of their respective regions, the three IBSA countries also represent the larger interests of Sub-Saharan Africa (SSA), South America and Southern Asia. This is especially true of Brazil and South Africa, being the most significant economies within Common Market of the South (MERCOSUR) and Southern African Customs Union (SACU), the regional trade agreements that brings together the Southern Latin American and Southern African nations, respectively. While India is the most important economy in Southern Asia, its institutionalised economic linkages within South Asia is still at a developmental stage as India negotiates FTAs with Association of South East Asian Nations (ASEAN) member states and seeks a more ambitious trade liberalisation agenda for the South Asian Free Trade Area (SAFTA). On 6th June 2003, the Foreign Ministers of India, Brazil and South Africa met in Brasilia to set up the India-Brazil-South Africa Dialogue Forum (IBSA) after informal talks between their respective head of state during the G-8 meeting in Evian, France on the basis of shared characteristics of these three semi-peripheral powers. President Thabo Mbeki of South Africa, Lula da Silva of Brazil and Prime Minister Atal Bihari Vajpayee of India formally launched IBSA during the UN General Assembly in September 2003. The leaders of the three states have consciously advanced themselves as campaigners for an emerging developing world.. The IBSA Trilateral Commission was constituted in the aftermath of their participation in the G8 summit of 2003. It aimed to formalize relations and provide a forum for coordinating strategy between these leading industrial countries of the South (www.ibsa-trilateral.org, 2003 and Taylor, 2010: 86). The IBSA initiative should be seen as an endeavour to intensify the global bargaining power by three pivotal states. Prior to initiating the IBSA dialogue forum, there had been negotiations for

trade agreements between MERCOSUR¹ and SACU² as a means toward establishing a future free-trade agreement for some time, as well as a preferential trading deal between India and Mercosur on reducing tariffs on selected products in bilateral trade, that concluded in January 2004. Thus, the establishment of the IBSA is a step forward in cementing the already existing economic relations between the three states. The growing significance of IBSA cooperation in the international trade is reflected in the increasing share of these three countries in world merchandise trade.

In the emerging global scenario, energy security is the main focus of any bilateral or multilateral organisation. Therefore, the working group of IBSA also aims to promote clean and efficient sources of energy such as bio-fuels. It also gives an opportunity to exchange information about renewable energy and use of non-conventional energy sources which is essential to fulfil their future energy requirements. This concern is also visualised in the recently concluded IBSA summit held in Brasilia on April 15, 2010. The energy sector is significant in all three countries. Among the three countries, Brazil is the only one, which has acquired self-sufficiency in oil in 2006, even though none have sustainable reserves for the long-run. All three countries are emerging powers and are ambitious in their energy policies. Moreover, South Africa, India and Brazil have committed to develop and employ alternative sources of energy.

Trade of Strategic Minerals among IBSA members

The focus area of the paper is trade of strategic mineral resources among three countries. The growing domination of the North over the South in the use of strategic minerals lies at the heart of the conflict. All the three IBSA countries are blessed with major endowments of mineral resources and have historically well developed mining and metallurgy industries. IBSA stakeholders in the mining sector have been witnessing an increase of their global profile and clout in the current years and have not been averse to global acquisitions to expand their production portfolio.

South Africa dominates the production and export of *PGMs*, including platinum, palladium and iridium as well as rhodium and ruthenium. *PGMs* have a number of unique properties, such as resistance to high temperatures and ability to catalyze chemical reactions, which make them irreplaceable in a wide range of applications. High global demand for platinum is driven by two main uses: automotive catalytic convertors, which convert harmful emissions into relatively inert exhaust and jewellery. Iridium is used in petroleum and automobiles. Rhodium, ruthenium and other less common *PGMs* are experiencing production and supply problems; as these are difficult to extract and refine and are less prevalent. Ruthenium and iridium are in high demand because they provide vertical memory storage for hard drives and lighting. Currently, there are no problems with the supply of platinum and palladium and the market is functioning well; recycling and below ground reserves guarantee continuing supply. World platinum suppliers, dominated by South Africa, struggle to satisfy global demand for a metal that is virtually irreplaceable in several catalytic and industrial applications. South Africa's Bushveld Complex contains some 75 percent of world platinum reserves, occurring together

with other PGMs and other valuable minerals such as cobalt. Mining in the Bushveld Complex accounts for about 80 percent of world supply. South Africa, in addition, can also emerge as a major supplier of Chromium and Vanadium.

Mineral Policy

Today most of the states have clear mineral policy. Countries like India, South Africa and Brazil are the fastest growing economy in the world with GDP increasing at the rate of 8–9 percent per year and this block has great potential of natural resources. To maintain the requisite availability of strategic mineral for national security is one of the main components of making of their foreign and domestic policy. Country like India has crucial role in South Asia and suffer from acute security deficit syndrome vis-à-vis Pakistan and China. South Asia also affects rest of the African countries and Brazil has few problems but India needs rare strategic minerals for purpose of defence. As such, policy makers are keeping in mind the availability of strategic minerals resources in the region. IBSA countries sign MoUs on minerals policy, distribution and export-import policy within member states and assure that they will not provide these crucial minerals to countries like Pakistan and China. But China is the main contender of India in Africa and Asia region. IBSA countries organise regular meetings to explore comprehensive policy on strategic minerals.

Cooperation in Strategic Mineral Resource among IBSA members states

The success of the trilateral cooperation between the countries of South Africa, India and Brazil will solely depend on their commitment to forge ahead in keeping with their complementarities. All the three nations are highly cohesive in terms of their political structure and share an imperial–colonial past, which have defined their societal foundations in many parallel ways in the political, economic and social spheres. All the three countries have extensive belts of energy and mineral reserves that are untapped or under-utilised. A thorough understanding of their complementarities with respect to each other’s strengths and weakness will help to further elucidate the ample opportunities staring at their face, which calls for greater policy initiative and higher actualisation rate.

As the three countries enjoy considerable advantages in Strategic Mineral Resources (SMR), the expertise so gained can be mutually advantageous for them in the long run. The idea, here, is to develop each individual country as a regional hub for SMR. India, Brazil and South Africa should cooperate with each other in this process of transforming their market as the global hub for SMR exports across the globe. For these, the three countries need to enhance their inter-regional connectivity, especially maritime transportation links. Godfrey Oliphant (2012), Deputy Minister for Mineral Resources, South Africa has emphasised on the ‘historical links’ among the IBSA nations in benefitting from the comparative advantages in exploration of the SMRs. He said,

“There is need to increase the level of beneficiation of strategic minerals in a way that will align those efforts without industrial development and economic growth

imperatives. It is also intention of the beneficiation strategy to contribute to the development of another key jobs driver through New Growth Path, the knowledge economy, through increased R&D and innovation and development of competitive advantages as linked to priority value chains. These chains are iron ore and steel, energy commodities, autocatalytic converters and diesel particulates, titanium and jewellery. While we have completed the first two, we are in the process of finishing the last three. The department is also engaged in review of Minerals and Petroleum Resources Development Act (MPRDA). This is aimed at improving the current construct of the Act to remove ambiguities, make provisions for consultation processes and streamline licensing process." (Oliphant: 2012)

He further said, "All minerals will be accessible for foreign investors. We have also identified some strategic minerals such as those which are energy minerals, platinum group minerals, and manganese and chrome ore. Our resource-based comparative advantage can be transformed into a national competitive advantage."

Among IBSA countries, Brazil is the largest country in land area. It is the fifth largest country in the world in terms of geographical area. Brazil has the sixth largest economy in the world in terms of nominal GDP. With 8,870 mining companies operating in the country in 2011, it is one of the largest mineral producing countries in the world. In 2006, Brazil produced 46 industrial minerals, 22 metals and 4 fuel minerals and exported them to the global marketplace. The produced minerals were bauxite, copper, coal, chromite, gemstones, gold, iron ore, kaolin, manganese, niobium (columbium), tantalum and tin from large deposits. Brazil's reportedly large mineral reserves and other identified resources help make it one of the most dynamic markets in the world. As per Mineral Trade data for the year 2011, Brazil's exports and imports in minerals were around US\$ 236 billion and US\$ 209 billion, respectively. The mineral trade in the country contributes significantly to the country's trade balance.

South Africa is a world leader in mining. The country is famous for its abundance of mineral resources, accounting for a significant proportion of world production and reserves, and South African mining companies are key players in the global industry. South Africa's total reserves remain some of the world's most valuable, with an estimated worth of R 20.3-trillion (\$2.5-trillion). Overall, the country is estimated to have the world's fifth-largest mining sector in terms of GDP value. It has the world's largest reserves of manganese and platinum group metals (PGMs), according to the US Geological Survey, and among the largest reserves of gold, diamonds, chromite ore and vanadium. With South Africa's economy built on gold and diamond mining, the sector is an important foreign exchange earner, with gold accounting for more than one-third of exports. In 2009, the country's diamond industry was the fourth largest in the world. South Africa is also a major producer of coal, manganese and chrome. There is considerable potential for the discovery of other world-class deposits in areas yet to be exhaustively explored. South Africa's prolific mineral reserves include precious metals and minerals, energy minerals, non-ferrous metals and minerals, ferrous minerals, and industrial minerals. Given its history and mineral wealth, it is no surprise that the country's mining companies are key players in the global industry. Its strengths include a high level of technical and production expertise, and comprehensive research and development activities.

India is the second largest populous country in the world. With the 10th largest economy in the world in terms of nominal GDP and third largest in terms of Purchasing Power Parity (PPP), it is one of the fastest emerging economies in the world. Ajey Lele and Parveen Bhardwaj (2014) mentions that to sustain such an economy, the industrial and manufacturing industry plays an indispensable role; moreover, minerals play a vital role in sustaining this strategic industry. With its diverse geographical attributes, the country is endowed with significant mineral resources. Mining sector is an important segment of the Indian economy. Mining contributed about US\$ 45 billion which was 2.63 per cent of the country's GDP in 2011. India produces as many as 87 minerals, which include 4 fuel, 10 metallic, 47 non-metallic, 3 atomic and 23 minor minerals (including building and other materials). India also contributes significantly towards minerals such as barite, bauxite, chromium, coal, iron ore, limestone and manganese ore in terms of output, which was among the 10th largest in the world. In 2011, the Indian mining industry contributed about 2.63 per cent to the GDP which is one of the lowest vis-à-vis some of the larger emerging economies such as China (20 per cent), Australia (8 per cent) and Russia (14.7 per cent). However, this percentage is expected to increase between 7 per cent and 8 per cent in the near future due to increasing demand. The total number of mines in 2011-12 was estimated to be around 3,236 mainly dominated by larger number of small operational mines. The public sector companies account for 66.5 per cent of the total value of mineral production. The open cast mining is the main practice for mining in India accounting 80 per cent of the total mining. During 2011-12, estimated value for fuel minerals accounted for US\$ 28.69 billion or 68.22 per cent; metallic minerals, US\$ 8.39 billion or 19.94 per cent of the total value and non-metallic minerals including minor minerals US\$ 4.97 billion or 11.83 per cent of the total value. While India remains self-sufficient with regard to most of the minerals, there are a few minerals whose resources are limited and may not be sufficient to meet the domestic demand in the future. These minerals are the backbone of strategic industries like defence, space, nuclear, energy, etc. Hence, the availability of these minerals in the future to meet the domestic demand of strategic industries is crucial.

Demand and Applications of Strategic Mineral Resources

The demand for strategic mineral resources is derived from the production of their end use products, such as flat panel displays, automobiles, catalysts, etc. As a result, demand for strategic mineral resources depends on the strength of the demand for final products in which they are inputs. The rare minerals used for defence purposes are primarily found in two types of commercially available permanent magnet materials. They are Samarium -cobalt (SmCo) and Neodymium- iron -boron (NdFeB). NdFeB magnets are considered the world's strongest permanent magnets and are essential to many military weapons systems. SmCo retains its magnetic strength at elevated temperatures and is ideal for military technologies such as precision-guided missiles, smart bombs and aircraft. The superior strength of NdFeB allows for the use of smaller and lighter magnets in defence weapon systems. The permanent magnets containing neodymium, gadolinium, dysprosium and terbium are also used in numerous electrical and electronic components and generators for wind turbines. With the exception of

small amounts of yttrium, rare earths have yet to be included in the strategic minerals stockpile for national defence purposes.

Generally, the strategic minerals have been associated with national security purposes. The strategic importance of minerals is a function of its importance in defence applications, the extent to which defence actions are required to shape and sustain the market and the impact and likelihood of supply disruption. Many scientific organisations in the South Africa, India and Brazil have concluded that certain rare earth metals are critical to their national security and becoming increasingly more important in defence applications. Some experts are concerned that IBSA states are not doing enough to mitigate the possible risk posed by a scarcity of domestic suppliers. However, it appears that IBSA's position assumes that there are a sufficient number of supplier countries worldwide to alleviate the potential for shortages.

Challenges in Partnership

Although all three countries have historical and cultural relations but in a globalised world number of challenges has emerged. China is the big player in international market for its rapid economic growth. China entered in Africa very diplomatically and established good relation with many African countries. IBSA is cooperating to strengthen bilateral and trilateral relations as well among IBSA countries to counter emerging threat from China. Another challenge is the geographical discongruence between member states. India, Brazil and South Africa are situated in different continent; distance is the biggest challenge in trade-cooperation. Maritime transport is the only way for the transportation of goods. They are searching new ways to reduce distance.

Figure 3: Voyage Time among IBSA member states

Liner Services in IBSA	India-South Africa	South Africa- Brazil	Brazil-India
Average Voyage Time	16-18 Days	9-12 Days	None exist
Frequency	1 per Week	1 per Week	NA

(Source: Jayanta Roy and Banerjee, 2008: 34)

It is clear that the liner connectivity, time taken and the frequency of such connection are far below global standards. There are no direct lines between South Africa and India, despite both being part of the Indian Ocean connection. Containers travelling between India and South Africa need to be trans-shipped to Dubai, Oman, Singapore or Mauritius. Average voyage time of over two weeks for the relatively short distance between India and South Africa and the frequency of only one departure per week; highlight the poor connectivity between the two countries. Dedicated connections between India and Brazil do not exist and is dependent on any available routes from trans-shipment points in the West Asia (Dubai etc.) or through South-East Asia (Singapore). Added to such a woefully inadequate logistical connection is the

fact that the overall picture of trade facilitation, logistical efficiency and transportation costs for all three IBSA countries is below the OECD averages and is in need of serious reforms. The lack of inter-IBSA transport linkage issue is partly related to the lack of substantive trade-flows between the three countries. (Roy and Banerjee, 2008: 34-35).

IBSA countries are also regional hubs and they are not ready to lose their leverage in their respective region. Thus, regionalism factor is a big challenge, in fully utilizing cooperation within IBSA.

CONCLUSION

The IBSA countries are large, diverse and rapidly growing economies. Their future position in the global milieu of production is assured by their relatively young populations and their prudent investment over the years in higher education and skill accumulation. Furthermore, all the three countries are blessed with a rich endowment of natural resources. The three IBSA countries have a lot to contribute to each other's economies to augment this process of internationalization. However, current levels of inter-IBSA economic linkages, though it has been rapidly growing in recent times, are still far from optimal. Since a key challenge facing IBSA is how to overcome the physical, cultural and economic distance between its members, it would be imperative to simultaneously seek to bridge these three gaps. The significant progress achieved in bridging the economic distance so far shows that cultural and physical distances can be overcome if there is sufficient economic attraction and vice versa. To deal with the magnification of transport and other transaction costs due to the effects of remoteness, the steps that IBSA has already undertaken to address transport issues including for establishing air and maritime corridors between the three countries would need to be implemented urgently.

The success of IBSA, the definitive trilateral cooperation of the three pivotal 'Southern' states depend on the willingness of the governments of these countries, which have the capacity and capability to build regional institutions, to find an effective mechanism to challenge the existing system of the international regimes and to transform themselves into pillars of a just multipolar world. This depends on their willingness to walk the talk and give concrete shape to their benevolent ideals. Then let time to be a judge of that.

ENDNOTES

1. The Mercado Común del Sur (Mercosur) includes Argentina, Brazil, Paraguay and Uruguay as full members; Venezuela's full membership still has to be approved by the Mercosur member's parliaments. Bolivia, Chile and Peru are associated member states.
2. Southern African Customs Union (SACU) is the oldest existing customs union in the world, was established in 1910. It includes five countries of Southern Africa: The Governments of the Republic of Botswana, Kingdom of Lesotho, Republic of Namibia, Republic of South Africa and Kingdom of Swaziland.

REFERENCES

1. Alden, Chris and Vieira, Marco Antonio (2005). The New Diplomacy of the South: South Africa, Brazil, India and trilateralism, *Third World Quarterly*, **26**(7): 1077-1095.
2. Anderson, W. Ewan and Liam D. Anderson (1998). "Strategic Minerals: Resource Geopolitics and Global Geo-Economics". London: Wiley Publication.
3. Archer, A.A., (1981). *Trans. Instn Min. Metall*, **90A**, 1-6.
4. Butts, Kent Hughes and Paul R. Thomas (1986). "*The geopolitics of Southern Africa: South Africa as Regional Superpower*". London: Westview Press.
5. Chatterjee, Bipul and Dhoot, Swati (2006). Economic Co-operation between India-Brazil-South Africa: The Road ahead, *Synopsis*, **8**(2): 24-28.
6. Cooper, Andrew F. & Higgott, Richard A. and Nossal, Richard K. (1993). *Relocating Middle Powers: Australia and Canada in a Changing World Order*. Vancouver: University of British Columbia Press.
7. Cooper, Andrew F. (1997). A Conceptual Overview, in Cooper, Andrew F. (1997). *Niche Diplomacy. Middle Powers after the Cold War*. London: Macmillan, pp. 1-24.
8. Government of India (2004). *Report of the Trilateral (India-Brazil-South Africa) Commission Meeting*. IBSA Dialogue Forum, March 4-5, 2004, New Delhi.
9. Hveem, Helge (1986). 'Minerals as a factor in strategic policy and action', in Arthur R H. Westin G (Ed.). *Global Resources and International Conflict Environmental Factors in Strategic Policy and Action*. New York: Oxford University Press.
10. Knoph, Adolph (1946). 'Strategic mineral supplies', *Science Monthly*, **62**:5-14.
11. Lele, Ajey and Bhardwaj, Parveen (2014). '*Strategic Materials: A Resource Challenge for India*'. New Delhi: Pentagon Press and Institute for Defence Studies and Analyses, p. 80.
12. Ministry of Mines (2012). Annual Report 2011-12. Also available at [http://\(mines.nic.in/writereaddata/Contentlinks/1ed4a15b370646d7be2c6defb2ecf6c9.pdf](http://(mines.nic.in/writereaddata/Contentlinks/1ed4a15b370646d7be2c6defb2ecf6c9.pdf)
13. Mutambara, Tsitsi Effie (2010). *Examining South-South Trade Flows and Market Access Conditions: A Case Study of the India, Brazil and South Africa Development Initiative*, TIPS Data Notes and Reports.
14. Puri, Lakshmi (2007). "IBSA: An Emerging Trinity in the New Geography of International Trade", Policy Issues In International Trade and Commodities, *UNCTAD Study Series No. 35*, United Nations.
15. Roy, Dr. Jayanta and Pritam Banerjee (2008), 'IBSA: Redefining South-South Co-operation', *CII Newsletter*. Also available at http://newsletters.cii.in/Newsletters/mailer/LAC_Newsletter/october/Country%20Reports/ReportJuly09India-LatinAmericaandCaribbeanEconomic.pdf
16. Saxena, S. C. (2001). "*Africa: Economic and Strategic Issues*". New Delhi: Kalinga Publications.

17. Taylor, Ian (2005). 'South Africa: Beyond the Impasse in Global Governance', in John English, Ramesh Thakur, and Andrew F. Cooper (eds.), *Reforming from the Top: A Leaders' 20 Summit*. Tokyo: United Nations University Press, pp. 236-242.
18. Van Rensburg, W. C. J. & Anaejionu, Paul. (1986). 'Strategic minerals'. N.J: Prentice-Hall. Englewood Cliffs
19. Weston, Rae (1984). *Strategic Materials: A World Survey*, Croom Helm Publication.