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## TECHNOLOGICAL ASPECTS OF INDO-AFRICAN COUNTRIES

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### ABSTRACT

*This abstract examines the various technological aspects of Indo-African relations, emphasizing key areas like digital infrastructure development, innovation partnerships, and knowledge exchange. India, with its expanding tech industry, offers solutions in areas like tele communications, IT, fintech, and health technologies, which are highly relevant to Africa's development needs. The growing emphasis on collaborative initiatives like the India-Africa Forum Summit (IAFS) has further strengthened these ties, especially in fostering sustainable development through tech-driven solutions. Africa can accelerate its digital transformation while creating opportunities for shared economic growth by utilising India's expertise in areas like mobile technology, e-commerce, and renewable energy. the scope of India co-operation with African countries was limited. With the rapid growth of the Indian economy in the last two decades, an increase in the role of information technology in India's growth story and given that Africa is now the fastest growing region in the world and rapidly innovating in its own right, the scope of technology co-operation between India and Africa has now widened. This study also looks at the potential and problems associated with these technical partnerships, such as resource availability, capacity building, and incorporating innovation into Africa's varied economies. The paper's ultimate goal is to shed light on how technology may promote mutual prosperity and act as a bridge for closer Indo-African ties.*

**Keywords:** Capacity Building, Collaborative Initiatives, Digital Transformation

### INDIA'S TECHNOLOGICAL LANDSCAPE

Over the past few decades, India has transformed into a global technology hub. The country's technology industry is projected to surpass \$245 billion in 2023, reflecting an annual growth rate of 8.4%. This sector contributes over 13% to India's GDP, underscoring its pivotal role in the national economy. Key drivers of this growth include a vast pool of skilled professionals, with India's universities producing the second-largest number of STEM graduates globally, and strategic government initiatives aimed at enhancing the research and development. Emerging technologies such as artificial intelligence, the Internet of Things, 5G, and big data analytics are at the forefront of India's digital transformation. These advancements are poised to reshape various sectors, including agriculture, healthcare, and education, propelling the nation towards its goal of becoming a leader in the intelligent age.

### TECHNOLOGICAL DEVELOPMENTS IN AFRICAN COUNTRIES

Africa's engagement with technology is multifaceted, with innovations tailored to address the

continent's unique challenges and opportunities. The proliferation of digital technologies has led to improvements in government services, economic activities, and social interactions. For instance, the adoption of mobile banking has significantly enhanced financial inclusion, while e-health initiatives are expanding access to medical services across remote regions.

Despite these advancements, Africa accounts for less than 1% of global research and development spending, and only 0.5% of the world's scientific researchers are based in sub-Saharan Africa. This disparity highlights the need for increased investment in education and infrastructure to fully harness the continent's technological potential.

Regional collaborations and embracing technological diversity are viewed as essential strategies for driving industrialization and sustainable development across African nations. Initiatives aimed at enhancing digital literacy and expanding internet access are pivotal in bridging the technological gap and fostering inclusive growth. In summary, both India and African countries are actively integrating technology into their development agendas. India focus on advancing its digital infrastructure and innovation ecosystem positions it as a key player in the global technology arena. Meanwhile, African nations are leveraging technology to address local challenges and stimulate economic growth, with an increasing emphasis on regional cooperation and capacity building to enhance their technological capabilities

## REVIEW OF LITERATURE

**Arun Mohan Sukumar's "Midnight's Machines: A Political History of Technology in India"** Arvind Sivaramakrishnan's review of Arun Mohan Sukumar's book delves into India's complex relationship with technology, tracing its evolution from the post-independence era to modern times. The book categorizes India's technological journey into distinct phases—Innocence, Doubt, Struggle, and Rediscovery—each reflecting the nation's shifting attitudes and policies towards technological adoption and innovation. Sukumar examines various technological endeavors, including the ambitious nuclear program and the embrace of computer technology, providing a nuanced perspective on how political and social factors have influenced technological progress in India.

**Rajiv Bhatia's "India-Africa Relations: Changing Horizons"** In her review, Shrabana Barua highlights Rajiv Bhatia's comprehensive analysis of the multifaceted relationship between India and African countries, with a particular focus on technological collaborations. Bhatia discusses initiatives like the Pan-African e-Network, which aims to enhance connectivity and knowledge sharing between India and African nations. The book also addresses the importance of aligning technological partnerships with Africa's development goals, emphasizing the need for India to engage thoughtfully and strategically to foster sustainable growth and mutual benefit.

**Binyavanga Wainaina's Perspectives on African Technological Narratives** Binyavanga Wainaina, though not directly focused on technology, offers critical insights into the portrayal of African societies, which can influence perceptions of technological development. His essay "How to Write About Africa" deconstructs stereotypes and encourages a more nuanced understanding of the continent's complexities, including its technological aspirations and challenges. Wainaina's work calls for authentic storytelling that acknowledges Africa's diverse experiences, which is essential for framing its technological narratives accurately.

**Nandan Nilekani's Initiatives in India's Technological Sphere**, Nandan Nilekani's efforts, such as the launch of Adbhut India, reflect a strategic approach to leveraging technology for national development. His focus on creating public infrastructure for artificial intelligence (AI) tailored to India's linguistic and cultural contexts aims to ensure equitable access and address unique challenges. Nilekani's initiatives underscore the importance of aligning technological advancements with the socio-cultural fabric of the nation to maximize their impact. These reviews collectively shed light on the intricate interplay between technology, politics, and societal development in India and African countries, emphasizing the need for contextually relevant and culturally sensitive technological strategies.

**Rajaram and Pasupathi (2025)** India and Africa trade has been growing faster than world output indicating that the international market is expanding faster than the domestic markets. There are indeed many Indian firms too whose India and Africa business is growing rapidly then the domestic business. This article examine changes in the pattern of India-Africa trade visible import and export from 2017-18 to 2022-23.

**Muthukumar and Surya (2025)** In conclusion, the bilateral trade relationship between India and Sub-Saharan Africa has evolved significantly over the past five years, with India's exports demonstrating remarkable growth, particularly surging to \$42.85 billion in 2022-2023. This indicates India's commitment to strengthening its economic ties and tapping into the diverse markets of Sub-Saharan Africa. The shift to a positive trade balance suggests an effective strategy in sourcing and exporting, allowing for a more favorable economic landscape. To sustain this momentum, strategic initiatives such as enhancing trade agreements, focusing on value-added products, and fostering capacity-building initiatives are essential. By leveraging these strategies, both India and Sub-Saharan Africa can unlock further potential, ensuring a balanced and mutually beneficial relationship.

**Jeeva and Ravichandiran (2025)** The trade relationship between India and Africa has witnessed substantial growth and diversification over the past few decades, driven by a shared vision of economic development, sustainable growth, and regional cooperation. As one of the largest emerging economies, India has become a key trading partner for Africa, offering a range of goods and services, from pharmaceuticals and machinery to technology and agricultural products. In return, Africa has provided India with vital resources, including mineral fuels, precious metals, and agricultural commodities. India's exports to Africa primarily include mineral fuels, pharmaceutical products, vehicles, and machinery, while imports from Africa are dominated by mineral fuels, precious metals, and copper. This paper is mainly focus on Region wise imports and Exports and top ten imports and exports of Africa.

**Priyadharshini (2025)** In recent times, African economics have been severely affected by the aftermath of the COVID-19 Pandemic and geopolitical uncertainties which have impacted global economies through various direct and indirect channels. African economic outlook 2024, average real GDP growth is estimated to have slowed from 4.1% in 2022 to 3.1% in 2023. The decline is attributed to a variety of factors. Including persistently high food and energy prices on account of the Russia-Ukraine war, weak global demand weighing down export performance, climate change and extreme weather events impacting agricultural productivity and power generation, and pockets of political instability and conflict in some African countries. India-Africa trade relations have immense potential for overcoming obstacles and sustainable growth. This initiative seeks to promote India-Africa trade, investment and economic cooperation in order to develop economic growth and development in both countries.

**Remesh and Shanmugam (2025)** The rising significance of Indo-African relations in the contemporary global context has drawn considerable attention from policymakers, academics, and business leaders alike. This paper explores the economic dimensions of cooperation between India and Africa, examining historical ties, trade relations, and investment patterns. With India's ambitious 'Act East' policy and Africa's burgeoning markets, the potential for economic collaboration has expanded significantly. This study analyzes the bilateral trade growth, focusing on key sectors, including agriculture, technology, and pharmaceuticals. The paper also addresses the challenges that hinder deeper economic integration, such as infrastructure deficits, policy inconsistencies, and the need for capacity building.

#### **OBJECTIVES OF THE STUDY**

- To Assess the Impact of Technology on Socio-Economic Development
- To Analyze Collaborative Initiatives between India and African nations.
- To Identify Challenges and Barriers in technological progress

- To Explore Policy and Institutional Frameworks in fostering technological development and innovation ecosystems.

## **HISTORICAL AND INSTITUTIONAL FOUNDATIONS**

Since the 1960s, India has actively engaged in technological cooperation with African nations through initiatives like the Indian Technical and Economic Cooperation (ITEC) Programme. ITEC focuses on manpower development, with African countries being prominent beneficiaries. Additionally, the establishment of the Pan-African e-Network in 2009 exemplifies India's commitment to bridging the digital divide by providing tele-education and telemedicine service.

### **Sectoral Collaborations**

The technological collaboration between India and African countries has significantly evolved, fostering mutual growth and development. This partnership emphasizes the exchange of knowledge, infrastructure development, and capacity building across various sectors.

#### **Information and Communication Technology (ICT):**

India's expertise in ICT has been pivotal in enhancing digital infrastructure in Africa. The Pan-African e-Network project, for instance, connects all 55 African Union member states, facilitating access to tele-education and telemedicine.

#### **Renewable Energy:**

Recognizing Africa's vast renewable energy potential, India has extended credit lines for constructing solar power plants in countries like Niger and hydroelectric projects in nations such as Burundi and the Democratic Republic of Congo. These initiatives aim to provide sustainable energy solutions and improve quality of life.

#### **Agriculture:**

Given the agro-climatic similarities between India and Africa, agricultural technology transfer has been a focal point. Institutions like the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) have established agribusiness incubators in several African countries, promoting agricultural innovation and productivity.

#### **Capacity Building and Skill Development**

India's provision of scholarships and training programs has significantly contributed to capacity building in African nations. The CV Raman Fellowship, initiated in 2010, allows African researchers to engage in collaborative research in Indian institutions, fostering knowledge exchange and skill development.

#### **Infrastructure Development**

The Asia-Africa Growth Corridor (AAGC), launched in 2017, is a strategic initiative aimed at enhancing connectivity and economic cooperation between Asia and Africa. This project focuses on developing quality infrastructure

Issues and Challenges in Technological Collaborations:

India and African nations have encountered several challenges in their technological collaborations, impacting the effectiveness and sustainability of their partnerships.

Key issues include:

#### **1. Funding Constraints**

Securing adequate financing remains a significant hurdle for many African tech startups. Approximately 90% of these startups struggle to obtain necessary capital, with only about 9% of total funding directed to early-stage companies. In 2019, African startups attracted merely \$1.43 billion in funding, a stark contrast to the higher investments seen in regions like North America and Asia. This funding gap hampers innovation and the growth potential of emerging businesses.

#### **2. Infrastructure Deficiencies**

The lack of reliable infrastructure poses significant challenges. Issues such as inconsistent energy supply, with companies facing high operational costs due to frequent outages, and unreliable internet connectivity, hinder the growth of tech enterprises. At the end of 2021, only

22% of Africa's population engaged with mobile internet services, despite the availability of modern 3G and 4G networks. These infrastructure gaps limit the scalability and efficiency of technological initiatives.

### 3. Regulatory Fragmentation

Navigating a complex web of regulations across different African countries can be daunting for tech entrepreneurs. The absence of a common currency and single market adds to the complexity, making cross-border operations challenging. This fragmentation can impede the growth of startups aiming for regional expansion and reduce the overall competitiveness of African tech enterprises.

### 4. Limited Access to Venture Capital

Access to venture capital is restricted, with only 8% of fintech startups reaching the Series B funding stage. This scarcity of funding options, coupled with a competitive market environment, often leads to the closure of startups that cannot secure necessary capital. The concentration of tech investments in countries like Nigeria, Egypt, Kenya, and South Africa further limits opportunities for startups in other regions.

### 5. Competition from Other Nations

India faces stiff competition from other emerging powers, notably China, in Africa. China's substantial investments in infrastructure, financial assistance, and resource extraction have significantly increased its influence across the continent. This competition challenges India's efforts to strengthen its technological partnerships in Africa.

### 6. Delayed Project Implementation

Timely execution of projects has been a concern, with instances of delayed completion affecting the impact of technological collaborations. Such delays can strain resources and diminish the intended benefits of these initiatives.

### 7. Political Instability

Political instability in certain African regions poses risks to technological collaborations. Recent events, such as coups in countries like Mali, Chad, Guinea, Sudan, and Burkina Faso, coupled with prevalent corruption, can disrupt ongoing projects and deter future investment.

### 8. Perception and Acceptance

Despite the potential benefits, there have been instances of resistance to foreign involvement. For example, the decision to jointly develop naval facilities in Assumption Island faced opposition within Seychelles, highlighting challenges in aligning interests and gaining local support for collaborative projects.

### 9. Instances of Xenophobia

Occurrences of violence against African nationals in India, particularly students, have raised concerns. Such incidents, rooted in xenophobia and racism, threaten to strain diplomatic relations and tarnish India's image as a partner in African development.

Addressing these challenges requires a comprehensive approach, including:

- **Enhanced Financing:** Developing innovative funding mechanisms and increasing investment in early-stage startups.
- **Infrastructure Development:** Investing in reliable energy and internet services to support tech growth.
- **Regulatory Harmonization:** Working towards unified regulations to facilitate cross-border tech initiatives.
- **Strategic Partnerships:** Collaborating with various international stakeholders to bolster technological capabilities.
- **Political Engagement:** Promoting political stability and addressing governance challenges to create a conducive environment for technological advancement.

By tackling these issues collaboratively, India and African nations can strengthen their



technological partnerships, driving sustainable development and economic growth across the continent.

## CONCLUSION

In conclusion, the technological collaboration between India and African nations presents promising avenue for mutual growth and development. While significant strides have been made in sectors like ICT, renewable energy, and agriculture, challenges such as funding constraints, infrastructure deficiencies, and regulatory complexities continue to impede optimal progress. Addressing these issues necessitates a collaborative approach, emphasizing strategic investments, infrastructural enhancements, and policy harmonization. By leveraging their respective strengths and fostering deeper partnerships, India and African countries can unlock vast potential, paving the way for a prosperous and technologically advanced future.

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