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VIKSIT BHARAT @ 2047: ROLE OF SCIENCE, TRADE AND POLICY CONVERGENCE

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ABSTRACT
Viksit Bharat @ 2047 represents India's aspiration to become a developed nation by the centenary of its independence. Achieving this vision requires sustained economic growth, scientific advancement, technological innovation, international competitiveness, human capital development and environmental sustainability. This paper examines the interconnected roles of science and innovation, trade and economic integration, and policy convergence in advancing India's development objectives. It argues that these dimensions should operate as complementary components of a unified development strategy. Scientific research generates knowledge and technological capabilities, trade provides opportunities for commercialisation and access to global markets, and coordinated public policies create the institutional conditions necessary to convert innovation into economic and social progress.

India has made considerable progress in digital infrastructure, information technology, pharmaceuticals, entrepreneurship and innovation. Its 38th position in the Global Innovation Index 2025 demonstrates its growing innovation capacity. Nevertheless, relatively low research and development expenditure, infrastructure limitations, skill mismatches and insufficient integration into global value chains remain significant challenges. Addressing these constraints requires stronger university–industry collaboration, increased research investment, efficient trade facilitation, improved educational outcomes and coordination between the Union and State governments.

This paper proposes a Science–Trade–Policy Convergence Framework supported by digital infrastructure, human capital and sustainable development. It concludes that coordinated action across research, education, industry, trade and governance is essential for building an

innovative, inclusive, competitive and resilient Indian economy by 2047.

Keywords: Viksit Bharat @ 2047, Science and Innovation, Research and Development, International Trade, Policy Convergence, Digital Infrastructure, Human Capital, Global Value Chains, Sustainable Development.

1. Introduction

India's development journey has reached a crucial stage at which the quality, inclusiveness and sustainability of economic transformation will shape its position in the global economy. The vision of Viksit Bharat @ 2047 provides a long-term framework for achieving developed-country status by the hundredth anniversary of India's independence. This aspiration extends beyond increasing gross domestic product (GDP). It encompasses productive employment, scientific advancement, technological self-reliance, quality education, accessible healthcare, efficient institutions, social equality and environmental protection.

India possesses several advantages, including a large domestic market, a young population, an expanding digital economy, a growing entrepreneurial ecosystem and established capabilities in information technology and pharmaceuticals. These strengths provide a foundation for long-term development. However, their potential can be fully realised only when scientific knowledge, commercial activity and public policy reinforce one another.

The World Bank's Country Partnership Framework for India for FY2026–2031 connects development priorities with the Viksit Bharat vision, emphasising employment, infrastructure, human capital, private investment and climate resilience [1]. These priorities indicate that India's progress depends on strengthening both economic opportunities and the institutions that support them.

Economic growth is necessary, but it does not automatically guarantee higher productivity, better employment or equitable development. The central challenge is to translate growth into

improved living standards and internationally competitive productive capabilities.

This paper focuses on three interconnected pillars: science and innovation, trade and economic integration, and policy convergence. Science creates knowledge and technological solutions; trade enables their commercial application and market expansion; and policy convergence aligns research, education, finance, infrastructure and industrial development. Their integration can help India move towards a more productive, innovative and sustainable economy by 2047.

2. Objectives of the Study

The principal objectives of this paper are:

1. To examine the contribution of science, research and innovation to India's long-term development.
2. To analyse the importance of domestic and international trade in strengthening economic competitiveness.
3. To explain the need for coordination among scientific, educational, industrial, trade and technology policies.
4. To assess the roles of digital infrastructure and human capital in economic transformation.
5. To propose an integrated policy framework for achieving the objectives of Viksit Bharat @ 2047.

3. Research Methodology

This study adopts a conceptual and analytical approach based on secondary information from government publications, policy documents and international institutions, including the World Bank, World Trade Organization (WTO) and World Intellectual Property Organization (WIPO).

The analysis examines the relationships among scientific capability, trade performance, digital transformation, human capital and public policy. Rather than investigating these factors independently, it considers how they interact within India's broader development process.

The paper is exploratory and policy-oriented. It does not claim to establish statistical causation through an econometric model. Instead, it identifies important relationships, development constraints and policy priorities relevant to India's aspirations for 2047.

4. Science and Innovation as Foundations of Development

Science and technology are essential drivers of productivity, competitiveness and long-term economic progress. Scientific

discoveries can improve healthcare, agricultural productivity, industrial processes, energy efficiency, communication and environmental management. Technological innovation also enables businesses to reduce costs, improve quality and develop products for new markets.

India has established important capabilities in information technology, pharmaceuticals, biotechnology, space research, engineering and digital services. According to WIPO's Global Innovation Index 2025, India ranked 38th globally and remained a leading innovation economy in Central and Southern Asia [2]. Its performance reflects strengths in knowledge and technology outputs, information and communication technology services exports, and entrepreneurial activity.

Despite these achievements, important gaps remain. Research expenditure, infrastructure quality, institutional effectiveness and business sophistication require further improvement. WIPO's 2025 assessment reports that India's research and development expenditure was approximately 0.65 per cent of GDP in 2020 [2]. This historical figure highlights the need to strengthen research investment, although it should not be interpreted as the current expenditure level.

India must therefore improve the complete innovation process, from fundamental research to practical application. Universities and research institutions should receive adequate funding and modern facilities, while businesses should be encouraged to invest in research, product development and technological improvement.

The Anusandhan National Research Foundation provides an institutional mechanism for strengthening research and collaboration among academia, industry and government [3]. Its broader significance lies in encouraging scientific inquiry while improving the pathways through which discoveries can generate economic and social benefits.

A successful innovation ecosystem requires collaboration among researchers, entrepreneurs, investors, manufacturers and policymakers. Intellectual-property protection, technology-transfer

facilities, research grants and suitable financing can help scientific discoveries reach the marketplace.

For Viksit Bharat, scientific progress should be measured not only by publications and patents but also by improvements in productivity, public services, industrial capabilities and quality of life.

5. Trade and Economic Resilience

International trade contributes to development by expanding markets, encouraging specialisation, improving access to technology and connecting domestic producers with global production networks. It allows businesses to increase production, achieve economies of scale and learn from international competition.

India's merchandise trade includes petroleum products, pharmaceuticals, engineering goods, electronics, agricultural products, textiles and jewellery. WTO data indicate that India's merchandise exports were approximately US$434.4 billion in 2024, while merchandise imports were approximately US$721.2 billion [4]. These figures illustrate the scale of India's participation in international trade and the importance of strengthening export competitiveness and domestic productive capacity.

India's services sector is another major source of international economic engagement. Information technology, software development, business-process services and professional services have established the country as an important participant in the global services economy. Emerging opportunities in artificial intelligence, digital consultancy, research services and specialised professional activities could further strengthen this position.

However, long-term development requires diversification beyond established service industries. Advanced manufacturing, electronics, pharmaceuticals, food processing, renewable-energy equipment, biotechnology and other knowledge-intensive sectors can expand employment and increase domestic value addition.

The Foreign Trade Policy 2023 provides a framework for improving trade facilitation and strengthening India's export ecosystem [5]. Effective implementation requires reliable logistics, efficient ports, predictable regulations, access to finance and improved export support for micro, small and medium enterprises (MSMEs).

India should also deepen its participation in global value chains. Domestic firms can generate greater value by participating in research, design, component production, manufacturing, distribution and after-sales services rather than concentrating exclusively on final assembly or the export of basic products.

Trade must consequently be treated as more than a mechanism for increasing export earnings. When linked with science, industrial development and skills, it can accelerate technological learning, generate employment and strengthen economic resilience.

6. The Importance of Policy Convergence

Science and trade cannot deliver their full benefits when government policies operate independently or pursue conflicting objectives. Scientific discoveries may remain unused because commercial financing is unavailable. Innovative enterprises may struggle to expand because of inadequate infrastructure, limited technical skills or regulatory uncertainty. Export-oriented businesses may face difficulties when research institutions fail to address their technological requirements.

Policy convergence means coordinating different policy areas around shared development objectives. For India, this includes science and technology, education, industrial development, trade, finance, digital transformation, infrastructure, employment and environmental protection.

The National Education Policy (NEP) 2020 provides an important foundation by promoting multidisciplinary education, research, innovation and the development of skills relevant to emerging technologies [6]. Its objectives can be strengthened through closer collaboration among educational institutions, employers and research organisations.

For example, universities can identify emerging technological needs, industries can support applied research, financial institutions can provide suitable funding, and trade authorities can help innovative enterprises access international markets. Such coordination reduces institutional fragmentation and improves the practical application of research.

The relationship can be expressed as follows:

Education → Skills → Research → Innovation → Industrial Development → Trade → Productivity → Employment → Inclusive Growth

This sequence illustrates the importance of coordinated planning and implementation. Policy convergence does not require every institution to perform the same function. Rather, it requires each institution to contribute effectively to a common national objective.

Coordination between the Union and State governments is equally important because education, infrastructure, industrial development and employment involve different levels of administration. Shared indicators, transparent responsibilities and periodic evaluation can improve implementation.

7. Digital Transformation and Digital Capital

Digital technologies are reshaping production, communication, finance, education and public administration. India's digital public infrastructure demonstrates how technology can improve access to services and reduce transaction costs.

The Unified Payments Interface (UPI) has expanded digital payments and made electronic transactions more accessible to individuals and businesses. Digital platforms can also support e-commerce, telemedicine, online learning, agricultural information, logistics and government service delivery.

Digital capital refers to the technological infrastructure, data capabilities, digital skills, interoperable systems and institutional arrangements that enable productive use of digital technologies. It includes reliable connectivity, cybersecurity, digital literacy and the ability of businesses and citizens to use digital services effectively.

Artificial intelligence, automation and data analytics offer opportunities to improve productivity and develop new industries. However, their benefits depend on suitable infrastructure, trained personnel, responsible data governance and effective cybersecurity arrangements.

Digital development must also address unequal access. Rural communities, low-income households, small businesses and underserved regions may face limitations involving connectivity, affordability or digital literacy. Without targeted measures, technological progress could widen existing inequalities.

India should therefore pursue digital transformation alongside investments in physical infrastructure, education and social development. Technology should complement human capabilities and improve access to economic opportunities rather than exclude people who lack the necessary resources.

8. Human Capital and Employment Generation

Human capital encompasses education, health, knowledge, technical skills, experience and productive capabilities. It is fundamental to scientific research, technological adoption, industrial competitiveness and international trade.

India's working-age population presents a significant opportunity, but demographic potential alone cannot guarantee economic success. Its benefits depend on the availability of productive employment, quality education and skills that correspond to changing labour-market requirements.

The World Bank has emphasised the importance of improving skills and employment opportunities for India's development [1, 7]. Persistent mismatches between educational qualifications and industry requirements demonstrate the need to strengthen vocational education, apprenticeships and practical learning.

Schools should develop scientific reasoning, communication, problem-solving and digital literacy. Universities should promote research, interdisciplinary learning and collaboration with industry. Technical institutions should regularly update their curricula to reflect developments in artificial intelligence, advanced manufacturing, biotechnology, cybersecurity and renewable energy.
MSMEs can play an important role in employment generation, but they require access to finance, technology, skilled workers and markets. Entrepreneurship programmes and industry-linked training can help small businesses improve productivity and create sustainable employment.

Women's economic participation and opportunities for rural youth also deserve greater attention. Affordable childcare, safe working environments, accessible training and equal opportunities can help broaden participation in economic activity.

Human capital investment should therefore be regarded as a productive investment in India's future rather than merely an expenditure on social services.

9. Sustainability and Inclusive Development

A developed India must combine economic progress with environmental responsibility and social inclusion. Climate change, water scarcity, pollution, resource constraints and energy insecurity can undermine long-term prosperity if they are not addressed effectively.

Scientific research can support sustainable development through renewable energy, green hydrogen, energy-efficient manufacturing, electric mobility, climate-resilient agriculture, water conservation and circular-economy technologies.

Trade can help Indian enterprises access international markets for environmentally sustainable goods and services. However, businesses need predictable environmental regulations, appropriate financial incentives and access to clean technologies to make this transition economically viable.

Inclusive development is equally important. Regional disparities, differences in educational access, gender inequality and limited digital connectivity can prevent sections of society from benefiting fully from economic growth.

Public investment in health, education, transport, rural infrastructure and digital access can help reduce these disparities. Development programmes should also assess whether employment opportunities, technological benefits and improved public services reach disadvantaged communities.

Accordingly, progress towards Viksit Bharat should be assessed through a broad framework incorporating economic growth, scientific capability, employment quality, human development, social inclusion, environmental sustainability and institutional effectiveness.

10. A Proposed Science–Trade–Policy Convergence Framework

This paper proposes an integrated framework built around five mutually reinforcing pillars.

Pillar I: Scientific Capacity and Innovation**

India should progressively strengthen research funding, modernise research facilities, encourage private-sector research and promote collaboration between universities and industry. Technology-transfer mechanisms should help researchers convert discoveries into practical applications. Start-ups based on scientific innovation should receive suitable mentoring, financing and access to testing facilities.

Pillar II: Trade Competitiveness

Export development should focus on diversification, improved product quality, domestic value addition and participation in global value chains. Logistics infrastructure, customs procedures and access to trade finance should be improved. MSMEs require targeted support to meet international standards and enter overseas markets.

Pillar III: Policy Coordination**

Government departments should establish shared objectives connecting education, research, investment, industrial production, exports and employment. Coordination between the Union and State governments should be supported by measurable indicators, clear responsibilities and regular performance assessments.

Pillar IV: Digital Capital

Investment should strengthen digital public infrastructure, artificial intelligence capabilities, cybersecurity, data governance and digital literacy. Affordable connectivity and accessible digital services are essential for ensuring that rural and underserved communities benefit from technological development.

Pillar V: Human Capital and Sustainability

Education, vocational training, apprenticeships, lifelong learning and women's workforce participation should remain central priorities. Research and industrial policies should also support clean energy, resource efficiency and climate resilience.

Together, these pillars create a development system in which scientific knowledge supports industrial innovation, competitive enterprises access domestic and international markets, and coordinated policies ensure that the resulting benefits contribute to inclusive national progress.

11. Major Policy Recommendations

First, India should strengthen research and development investment through a combination of public funding, private-sector participation and collaborative research programmes. Both fundamental science and application-oriented research are necessary.

Second, universities should develop stronger partnerships with industry. Joint research projects, innovation centres, technology-transfer offices and entrepreneurship programmes can improve the relationship between academic knowledge and productive activity.
Third, trade and industrial policies should be aligned with technological development. Export promotion should encourage higher-value products, advanced manufacturing, knowledge-intensive services and greater participation in global value chains.

Fourth, education and skill-development programmes should respond more effectively to changing employment requirements. Practical training, apprenticeships and continuous professional development can improve workforce readiness.

Fifth, coordination across ministries and levels of government should be strengthened. Shared targets and transparent monitoring can improve policy consistency and implementation.
Sixth, digital transformation should be inclusive and secure. Investments in connectivity must be accompanied by digital literacy, cybersecurity, accessible services and responsible data governance.
Seventh, development assessment should extend beyond GDP. Indicators of productivity, employment quality, research capacity, learning outcomes, health, women's participation and environmental performance should inform policy decisions.

Finally, sustainability should be incorporated into industrial and trade strategies. Support for clean technologies and resource-efficient production can strengthen India's long-term resilience and international competitiveness.

12. Conclusion

Viksit Bharat @ 2047 is a comprehensive national transformation agenda that requires more than sustained GDP growth. It calls for stronger scientific capabilities, competitive industries, productive employment, skilled human resources, effective institutions and environmentally sustainable development.

Science and innovation provide the knowledge and technological foundations of productivity. Trade creates opportunities for market expansion, investment, technological learning and participation in global value chains. Policy convergence connects these capabilities by

aligning research, education, industrial development, finance, infrastructure and governance.

India has made meaningful progress in digital infrastructure, information technology, pharmaceuticals, entrepreneurship and innovation. Its position in the Global Innovation Index 2025 and its participation in merchandise and services trade demonstrate important strengths [2, 4]. Nevertheless, research investment, infrastructure, skills, employment quality, business sophistication and regional inequalities require sustained attention.

The central argument of this paper is that science, trade and public policy should be approached as components of one integrated development system. Universities must work with industry, businesses must invest in innovation, trade institutions must facilitate international market access, and educational institutions must prepare people for emerging opportunities.

This transformation must also remain inclusive and sustainable. Economic progress should generate productive employment, expand opportunities across regions and social groups, strengthen human capabilities and protect environmental resources.

Ultimately, achieving Viksit Bharat @ 2047 will depend on the effective coordination of knowledge, technology, capital, institutions, people and markets. A sustained Science–Trade–Policy Convergence Framework can help India transform its scientific, demographic and economic potential into long-term prosperity and establish a stronger position in the global economy.

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