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SCIENCE, TECHNOLOGY, AND INNOVATION COLLABORATION BETWEEN INDIA AND THE UNITED STATES

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Abstract

This study examines the expanding scientific, technological, and innovative cooperation between the United States and India. This study looks at the reasons for this cooperation, the difficulties in promoting teamwork, and the solutions put in place to deal with these difficulties. The cooperation is motivated by a common goal to tackle global issues and promote economic expansion. To improve their own innovation ecosystems, both nations are spending money on collaborative research projects and academic exchanges. The analysis emphasizes how crucial government programs like the U.S.-India Strategic Energy Partnership and the India-U.S. Science and Technology Endowment Fund are to fostering this cooperation.

Keywords: *Science, Technology, Innovation, India, United States, India-US Collaboration*

1. INTRODUCTION

India and the US have a vibrant partnership in science, technology, and innovation that aims to use each nation's advantages to address global issues and promote economic progress. This partnership covers a broad spectrum of industries, such as energy, healthcare, agriculture, information technology, space exploration, and environmental sustainability.

Fundamentally, this partnership entails sharing best practices, promoting innovation ecosystems in both nations, and working together on research and development projects. India and the US can tackle complicated issues more successfully and quicken the rate of scientific discovery and

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technological advancement by combining their resources, knowledge, and infrastructure. In the healthcare industry, for instance, Indian and American academics frequently work together on initiatives ranging from epidemiological studies to drug discovery and development. This kind of collaboration is well-known. In order to meet global health emergencies like the COVID-19 pandemic, when swift vaccine development and distribution efforts have profited from international cooperation, this alliance has been especially important. Furthermore, relationships between government agencies, startups, and the corporate sector are included in the collaboration, which goes beyond academic institutions and research centers. Technology transfer agreements and joint ventures make it easier to share information and resources, which promotes innovation and increases economic growth for both parties.

The establishment of bilateral agreements, joint funding initiatives, and high-level dialogues like the U.S.-India Strategic Energy Partnership and the India-U.S. Science and Technology Endowment Fund highlight the strategic significance of science, technology, and innovation collaboration between India and the United States. These platforms allow the sharing of ideas, resources, and technology between the two countries and offer frameworks for cooperation.

1.1.India-U.S. Technology Summit:

The India-US Technology Summit, with the subject "Tackling 21st Century Challenges Together," will be held in New Delhi on November 18–19. A number of hundred businesses, academic institutions, and scientists are expected to attend the summit, which will foster fruitful collaborations in cooperative R&D, technology commercialization, and cooperative business endeavors aimed at advancing investment and trade between our two nations. A government-to-government program run by the White House Office of Science and Technology Policy and the Indian Department of Science and Technology is one of the Summit's primary components. Another is a trade show and exhibition where American and Indian businesses, as well as organizations dedicated to economic development, can showcase their goods, services, and technological advancements. Expert panels comprising entrepreneurs, financiers, innovators, regulators, and community stakeholders will be featured at the Summit.

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1.2.US-India Science and Technology Joint Commission

New Delhi will host the Joint Commission Meeting (JCM) from November 14-17. Co-led by the Ministry of Science and Technology of India and the White House Office of Science and Technology Strategy, the JCM identifies present and future areas of joint effort between science agencies and offers strategic guidance on the overall heading of S&T relations. The Science and Technology Enrichment Fund and the Indo-U.S. Science and Technology Forum, which can use funds to carry out JCM outcomes, get strategic bearing from representatives in the JCM. Representatives also discuss strategy issues such as ladies in science and innovation and technology commercialization.

1.3.US-India Science and Technology Cooperation Agreement

During the visit of Indian Science and Technology Minister Kapil Sibal to the United States on October 17, 2005, the United States and the Public authority of India inked an umbrella Science and Technology (S&T) arrangement in Washington. The understanding aims to improve the scientific and mechanical capacities of both the US and India, foster more prominent ties between their respective enormous scientific and innovative communities, and encourage scientific and innovative collaboration in areas that will help the two nations.

This new arrangement will speed up cooperation among Indian and American scientists in government agencies, the confidential sector, and the scholarly world in areas like basic sciences, space, energy, nanotechnology, wellbeing, and information technology that will progress scientific understanding and advantage the entirety of our peoples. It also establishes for the first-time intellectual property right protocols and different provisions necessary to conduct dynamic cooperative research.

Since the mid 1960s, India and the United States have kept up with close scientific and commercial ties. These ties started in agriculture and later expanded to include most U.S. government specialized agencies in a large number of fields. A $110 million PL480 "Rupee Fund" was formed in 1987 by the United States and India to support and encourage scientific and specialized participation as well as educational and cultural exchanges. Up until 1998, the Rupee Fund

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Understanding encouraged a large number of joint activities between the United States and India. The residual PL480 Rupee Funds were used to build the Indo-U.S. Science and Technology Forum (Forum), which was founded in 2000.

By supporting seminars, scientific exchanges, and meetings, the Forum explores and identifies fruitful areas of collaboration, which strengthens the respective association between the United States and India. It supports interactions between young, splendid scientists and has supported significant events like the India-United States Meeting on Space Science, Applications and Trade, as well as initiatives in technology innovation and environmental change. Through its capacity to work with additional specialized partnerships, the new scientific and technology understanding will upgrade crafted by the Indo-U.S. scientific and Technology Forum.

Negotiations for a two-sided science and technology understanding between the United States and India finished in 1993 due to disagreements over intellectual property rights (IPR) clauses. Nonetheless, both the US and India understand that a science and technology understanding is essential given the current state of our respective relations and the quick headway of mechanical capabilities.

2. LITERATURE REVIEW

Nichols' (2008) investigation explores the complex dynamics of innovation, change, and order in the context of science and technology policy using three different countries as a comparative lens. Through an examination of these countries' policies and practices, Nichols hopes to disentangle the forces behind scientific and technical progress in each of their environments, illuminating the relationship between innovation, laws, and social order.

Freeman's (2015) Work refocuses attention on how immigration and cross-border cooperation have shaped the terrain of scientific and technological innovation worldwide. By means of an extensive examination, Freeman emphasizes the value of international cooperation and the inflow of varied expertise in propelling discoveries and developing creativity worldwide, underscoring the interdependence of countries in the quest of scientific advancement.

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Kennedy's (2018) investigation explores the complicated dynamics of cooperation between large international actors—China, India, and the United States in particular—in order to advance innovation. Kennedy offers insightful analysis of the complex dynamics and power conflicts that exist inside these partnerships, as well as the ways in which strategic alliances influence the direction of global innovation.

Chaurasia et al.'s (2018) An in-depth examination of research collaboration between the United States and India within the given time period provides a targeted perspective on the workings of international scientific cooperation. The authors examine the trends, motivations, and results of cooperation between these two countries through empirical research and case studies, providing insightful information about the elements that support or obstruct productive research collaborations.

Ladwig and Mukherjee's (2019) analysis explores the wider ties between the US and India, including any possible points of convergence with cooperative efforts in science and technology. The authors hope to shed light on the complex dynamics that influence cooperation efforts in science, technology, and other fields by examining the political, economic, and cultural aspects of this bilateral relationship. This will provide readers a thorough understanding of the variables influencing transnational cooperation between these two countries.

3. UNITED STATES AND INDIA ARE BECOMING SCIENCE PARTNERS OF CHOICE

This year, Achyuta Adhvaryu, a researcher in economics and public policy, relocated from Michigan to San Diego, California, to establish the 21st Century India Center at the University of California, San Diego.

The center's goal is to create new relationships between university researchers and scholars at prestigious Indian universities. Adhvaryu notes that this is a challenging endeavor given India's extensive system of higher education, which consists of almost 50,000 academic institutions. Staff members at the center serve as go-betweens, arranging meetings and providing financing for outings that might not have developed naturally.

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According to Adhvaryu, the center was founded in view of India's expanding scientific and economic might. According to him, "it is evident that research and policy on United States and India relations need to come together."

US universities are searching abroad for partnerships as chances for new research cooperation between the US and China diminish due to increased political tensions. India is a country that the US is turning more and more to for international research collaborations and students, but deepening these ties presents new difficulties. In addition to overcoming obstacles related to regulations and legislation, institutions must negotiate notable structural and cultural variations in the higher education systems of the respective nations.

In order to create long-lasting collaborations, governments in both countries need to amend laws that prevent faculty exchanges and collaboration, Indiana. It is imperative that academics and students recognize the significance of these transnational relationships, for example, by examining instances of productive collaboration between Indian and US researchers. According to Arola, "institutional partnerships are about relationships between people, not between entities."

Based on their mutual respect for academic freedom and democratic values, India and the US have a lot to gain by working together, according to Diya Dutt, who provides international collaboration advice to the Association of Indian Universities in Delhi. India, which has over 38 million students, is a great place to find talented young people, particularly since that Chinese students are becoming less interested in studying in the US. India can bolster its research and higher education sectors by acquiring access to top-notch infrastructure and academic forums in the United States, according to Adhvaryu.

As per Dutt, India's contributions to international collaborations are supposed to turn out to be more substantial than they have in the past due to its expanding scientific prowess. As indicated by Elsevier's Scopus database, India surpassed Germany in 2019 as the nation with the highest overall number of research papers annually.

3.1.Growing role

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At the point when US President Joe Biden and Indian State head Narendra Modi announced a helpful initiative to expand research cooperation in space, defense, and emerging technologies in May of last year, it served as a catalyst to further strengthen ties between the two countries. Among other things, it contains an agreement to start 35 jointly supported programs in fields including quantum technology and artificial intelligence, which was made between the US National Science Foundation and Indian science organizations. Additionally, it would broaden an exchange program that will allow scientists and engineers from the US and India working on space and military research to collaborate on projects in each other's governments.

As per Philip Altbach, an emeritus professor at Boston School in Massachusetts who studied international advanced education systems, the effort demonstrates that the two governments are serious about science relationships and may inspire universities to make their own bridges. Due to a "do-it-yourself" mentality, India has traditionally chosen to concentrate its research efforts within its borders, but Altbach notes that the country is starting to explore outside.

For instance, the Indian government introduced an education strategy that encourages worldwide participation in 2020. As indicated by Shakila Shamsu, a former officer of India's Division of Advanced education and co-author of the education strategy, a piece of this plan is to join by 2040 advanced education institutions that were founded based on discipline into interdisciplinary universities.

According to Shamsu, the plan intends to raise education financing from about 3% of GDP to 6% of GDP and to establish partnerships and programs with foreign universities to position India as a top international destination for teachers and students. Additionally, it has prepared the way for foreign universities to establish campuses in India. Deakin University and Wollongong University, two Australian universities, said earlier this year that they will be the first to benefit from this reform.

Shamsu notes that while significant changes will take time, some progress has already been accomplished. The 2020 National Education policy suggested the establishment of another National Research Foundation, which will be housed in the Division of Science and Technology

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and get 500 billion rupees (US$6 billion) in funding throughout the span of five years from both public and confidential sources. The recommendation was approved by the Indian Parliament in August. Nonetheless, there are still significant disparities between the US and Indian research and education institutions that pose a threat to cooperation. Despite the magnitude of its educational system, decades of underfunding have prevented India from having a top-tier institution, according to Dutt. The Indian Institute of Science, situated in Bengaluru and positioned 122nd in 2022, is the main university in India in the main 150 scholarly institutions overall in the natural sciences as per the Nature File. Compared to China (2.4%) and the US (3.4%), the nation invests far less in research and development—less than 1% of GDP.

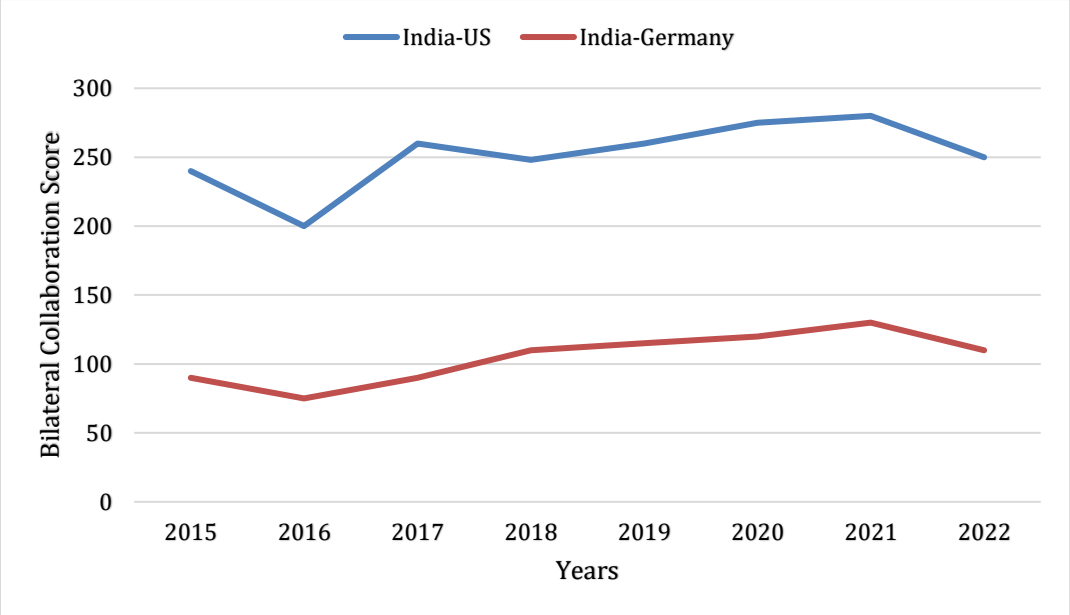

Figure 1: India-United States Connection

With over two times the reciprocal coordinated effort score for 2015 to 2022 as its partnership with Germany, India's partnership with the US is by a long shot its most fruitful.

4. US-INDIA COLLABORATION ON TECHNOLOGY

The globe has become a global village due to technological advancements. Today, nations are working together to develop and improve technology that can improve their security and economy. A joint declaration on strategic partnership for cooperation on important and emerging

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technologies was recently inked by the US and India. In order to promote collaborative research and development in cutting-edge technology, the United States and India have teamed together to launch an initiative on critical and emerging technologies. The program seeks to advance technological advancement and fortify the two countries' bilateral ties.

India and the US have a long-standing strategic alliance and have been working together in a number of areas. Their collaboration has taken on new dimensions with the release of their joint declaration on crucial and emerging technology. The partnership seeks to advance and create cutting-edge technologies in cybersecurity, quantum computing, and artificial intelligence. These technologies have the power to completely alter both nations' security and economic environments. Governmental and business organizations as well as academic and research institutions will work together.

4.1.Collaboration in Cybersecurity

Improving cybersecurity cooperation is one of the main goals of this project. India and the US both understand how crucial cybersecurity is in the modern digital environment. Cyberattacks on companies, governments, and people are becoming more frequent, and both nations have been the targets of these attacks. In order to stop and neutralize these kinds of assaults, the project seeks to promote the sharing of cybersecurity best practices and expertise.

4.2.Artificial Intelligence

The US-India collaboration is also centered on the advancement of technology related to artificial intelligence (AI). The project seeks to promote cooperation in this area as both nations have achieved notable strides in AI research and development. The partnership will progress the creation and application of AI across a number of industries, including transportation, agriculture, and healthcare.

4.3.Quantum Computing

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Another area that the US and India have committed to cooperating in under this program is quantum computing. There is a chance that quantum computing will transform a number of sectors, including healthcare, defense, and finance. The program seeks to improve information and expertise exchange while encouraging collaborative research and development in the field of quantum computing.

The program seeks to improve the two nations' technical collaboration. Cooperation in cutting edge fields including artificial intelligence, quantum computing, and cyber security will increase as a result of this program. This will strengthen ties between the two nations and promote technological advancement for the good of society.

5. INDIA-US INNOVATION HANDSHAKE MoU

On November 14, 2023, in San Francisco, the two nations signed a Memorandum of Understanding (MoU) on "Upgrading Innovation Ecosystems through an Innovation Handshake" inside the setting of the India-U.S. Commercial Discourse. The "Innovation Handshake" was broadcasted in the leaders' joint statement during the state leader's historic official state visit in June 2023.

At the inaugural industry roundtable in San Francisco called "Unraveling the "Innovation Handshake": U.S. - India Entrepreneurship Partnership," the Memorandum of Understanding was signed. Co-hosted by the U.S.- India Business Council (USIBC) and the Confederation of Indian Industry (CII), the occasion featured discussions on ways to further develop U.S.- India technology joint effort among CEOs from major ICT companies, executives from venture capital firms, and founders of startups in the critical and emerging technology space. It was supported by Startup India and the National Association of Software and Service Companies (NASSCOM).

The Memorandum of Understanding (MoU) was signed in light of the accompanying goals: to foster innovation and occupation growth, especially in critical and emerging technologies (CET) as characterized by the India-U.S. initiative for Critical and Emerging Technology (iCET); to address specific regulatory barriers to collaboration; to share information and best practices for startup fundraising; and to associate the unique startup ecosystems on the two sides.

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By signing the Memorandum of Understanding, parties focus on strengthening cooperation in Critical and Emerging Technologies (CET) and fortifying the startup ecosystem in profound tech industries. It is strategically set up to boost financial movement, attract capital, and make jobs, particularly for start-ups working in CET regions. A number of India-US Innovation Handshake events, information sharing, hackathons, and "Open Innovation" initiatives would the entire fall under the purview of the partnership.

The announcement set the stage for two more Innovation Handshake events that will occur in mid-2024 in the United States and India. These events will consist of a "hackathon" in Silicon Valley where startups from the two countries will try out ideas and technologies to assist with addressing worldwide monetary challenges, as well as an investment forum pointed toward assisting U.S. and Indian startups in putting up their creative ideas and products for sale to the public.

This historic move demonstrates the two countries' devotion to boosting mutual progress, opening doors, and encouraging innovation in the thrilling sector of emerging technology. The United States and India enter another time of joint effort set apart by the "Innovation Handshake".

The Commercial Dialogue (CD) is a helpful initiative between the United States and India at the ministerial level that aims to expand investment opportunities and work with exchange across a great many monetary sectors. It includes regular government-to-government meetings that are scheduled in tandem with private sector gatherings.

The fifth India-U.S. Commercial Discourse occurred on Walk 10, 2023, as a feature of U.S. Secretary of Business Gina Raimondo's visit, which occurred from Walk 8-10. During the gathering, the Commercial Discourse was relaunched with a strategic focus on boosting inclusive computerized economy, resiliency of supply chains, coordinated effort on environment and clean technologies, and post-pandemic financial recuperation, particularly for SMEs and startups.

Another Functioning Group on Talent, Innovation, and Inclusive Growth (TIIG) was established as a component of the Commercial Exchange. It was referenced that this Functioning Group would assist startups in accomplishing the objectives of iCET, especially in recognizing specific

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regulatory barriers to joint effort and advancing increased network between our innovation ecosystems, with an emphasis on start-ups through designated suggestions for agreeable efforts.

6. COCNLUSION

In conclusion, India and the US's engagement in science, technology, and innovation constitutes a strategic alliance with the ability to tackle global issues and promote reciprocal economic progress. Institutional mechanisms such as the India-U.S. Science and Technology Endowment Fund, knowledge sharing, and cooperative research projects all contribute to the development of this relationship. India and the United States can make sure that this collaboration remains a driving force for scientific discovery, technological advancement, and societal improvement by utilizing their respective strengths and cultivating an innovative culture.

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