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The emerging architecture of India-us digital trade: Evaluating the role of AI, data flows, and high-skill talent mobility in shaping future bilateral trade relations

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Abstract
India and the United States have evolved one of the most dynamic bilateral economic relationships in the world, driven increasingly by digital trade, cross-border data flows, artificial intelligence (AI), cloud computing, and the mobility of high-skill technology professionals. The structure of global trade is shifting from traditional goods toward intangible digital services, algorithms, and knowledge-based activities, making the India-US partnership strategically significant for both economies. This paper examines the emerging architecture of India-US digital trade by analysing three critical pillars: (a) AI-enabled services and emerging technologies, (b) cross-border data flows and digital regulatory frameworks, and (c) high-skill talent mobility, particularly involving the Indian diaspora in the U.S. technology ecosystem. Using secondary data from the WTO, UNCTAD, USITC, MEITY, NASSCOM, and OECD, along with an analytical review of existing literature, this study identifies key trends and challenges in the bilateral digital trade system. Findings show that India's digital services exports to the U.S. continue to rise sharply, driven by cloud services, fintech, cybersecurity, and AI-based solutions. However, unresolved issues such as data localisation, differing privacy standards, and visa restrictions for high-skill workers pose structural risks. The study concludes by recommending policy frameworks that advance interoperability of digital regulations, promote collaborative AI research, facilitate secure data flows, and enable smoother mobility of skilled professionals. The paper contributes to emerging scholarship by mapping the future trajectory of India-US digital trade and highlighting policy mechanisms necessary to strengthen this fast-growing bilateral corridor.

Keywords: Digital trade, Trade relations, Talent mobility, Diaspora network, Artificial intelligence, Data governance

Introduction
The global economy is undergoing a structural transformation driven by digital technologies, artificial intelligence (AI), data-based services, cloud infrastructure, and platform-driven innovation. In this emerging paradigm, digital trade defined broadly as trade in goods and services delivered digitally or enabled by data has become one of the fastest-growing domains of international economic exchange. For India and the United States, two of the world's largest technology-driven economies, digital trade has moved from a peripheral domain to a central pillar of their bilateral relationship.

India-US digital trade is no longer limited to IT outsourcing or back-end services. It now includes advanced software engineering, AI model development, fintech services, cybersecurity, quantum computing, digital public infrastructure (DPI), and data-driven R&D collaboration. According to NASSCOM, more than 60% of India's IT and IT-enabled services (ITeS) exports are directed to the United States. At the same time, the U.S. benefits from India's vast talent pool, with Indian-origin professionals constituting a major share of STEM workers, AI researchers, and digital entrepreneurs in Silicon Valley.

This deepening interdependence is reshaping bilateral trade relations, especially as intangible digital services expand faster than physical goods. However, the architecture of digital trade also involves tensions such as the U.S. preference for free data flows versus India's emphasis on data sovereignty, regulatory differences in privacy standards, and immigration barriers affecting high-skill workers.

This research aims to analyse the structural evolution of India-US digital trade by integrating technological, regulatory, and human capital perspectives. It provides an analytical framework for understanding how emerging technologies and policy environments will shape future trade interactions.

Literature Review

The literature on digital trade highlights the global transition toward intangible, data-driven forms of value creation. WTO (2023) [4] and UNCTAD (2024) [5] observe that digital services software, cloud computing, AI solutions are becoming central to international trade, reshaping economic structures in both developed and developing countries. Baldwin (2019) [2] further argues that globalization has entered a new era where digital labour and automation reshape comparative advantage. These foundational studies help situate India-US digital trade within broader global trends.

A prominent body of research concerns data governance and its implications for digital trade. Aaronson and Leblond (2018) [1] introduce the idea of "data realms," describing the fragmentation of global digital governance into distinct regulatory blocks led by the U.S., EU, and China. Chander (2021) [12] argues that cross-border data flows create regulatory spillovers, making data governance a key determinant of competitive advantage. Singh and Rajan (2021) [23] analyse India's push for data localisation and highlight the potential economic and strategic benefits of governing domestically generated data. The DPDPA (MEITY, 2023) reinforces India's sovereign orientation, contrasting sharply with U.S. positions in the National Trade Estimate Report (USTR, 2023) [16]. Together, these studies suggest that regulatory divergence between India and the U.S. may significantly influence digital trade momentum.

The literature also explores AI and technological capability as drivers of digital trade. NITI Aayog's National Strategy for AI (2018) positions India as an emerging global hub for applied AI engineering, while McKinsey (2022) [25] documents the rapid rise of India's SaaS ecosystem, driven by innovation clusters in Bengaluru, Hyderabad, and Chennai. Brynjolfsson and McAfee (2023) [3] emphasise that future trade competitiveness will be determined by AI adoption, productivity gains, and digital platform scaling. OECD (2022) [18] highlights measurement challenges in digital trade but confirms the rapid expansion of AI-enabled services globally.

On the U.S. side, USITC (2023) [8] notes the increasing dependence of American firms on offshore digital engineering hubs in India. Oxford Economics (2022) [27] shows cloud adoption across Asia-Pacific particularly India has been a catalyst for cross-border digital integration, while Azmeh and Foster (2020) [19] examine how global cloud architectures reconfigure power relations in global value chains. Taken together, these studies confirm that AI and cloud technologies serve as engines of bilateral digital trade.

Another significant theme is high-skill mobility, widely recognised as a critical enabler of innovation-led trade. Kerr (2018) [11] demonstrates that skilled migrants contribute disproportionately to U.S. innovation and startup creation. USCIS (2023) data confirms Indian dominance in skilled visa categories, which reinforces transnational networks for technology transfer. Dahlman *et al*. (2016) [29] argue that human capital is the most decisive factor for digital competitiveness, and Chakravorti (2020) [26] highlights India's digital talent advantage as a key source of global competitiveness. These analyses support the argument that mobility acts as a structural driver of India-US digital trade.

A related literature examines diaspora networks and innovation spillovers. Manyika *et al*. (2017) [20] show that digital globalization enables micro-services, remote teams, and distributed R&D models, all of which benefit from transnational diasporas. Research by Mohan (2022) [15] and Pant (2021) [14] links diaspora leadership in Silicon Valley to deeper India-US economic alignment. These studies indicate that mobility-driven knowledge exchanges underpin the growth of digital trade.

Finally, scholars discuss policy cooperation and geopolitics. The U.S.-India iCET framework (2023) highlights emerging cooperation in AI, semiconductors, and quantum computing. Melvin (2021) [30] examines India's digital public infrastructure as a potential model for global cooperation. Gereffi (2020) [22] extends global value chain theory to digital networks, underscoring the need for institutional mechanisms for digital integration. These perspectives emphasize that bilateral cooperation must evolve to govern technology-intensive trade.

Theoretical Framework

Digital trade in India-US relations can be examined through three modern theoretical lenses.

The first is the Knowledge-Capital Model of Multinational Enterprises, which argues that firms increasingly shift intangible tasks such as software engineering, AI development, and data analytics to locations with abundant human capital. This model explains why American technology firms outsource high-value digital processes to India and why Indian engineers dominate R&D teams in Silicon Valley.

The second is the Digital Gravity Theory, which extends classical gravity models by showing that digital trade occurs more intensely between countries with strong technological compatibility, linguistic alignment, diaspora linkages, and regulatory trust. In the India-US case, shared English-based business ecosystems, strong diaspora networks, and interoperable tech standards act as "digital gravity multipliers" that pull bilateral digital trade upward.

The third theoretical lens is the Data Governance and Digital Sovereignty Framework, which recognises data as a strategic economic asset rather than a passive by-product of digital activity. India's sovereign approach to data regulation and the United States' market-driven philosophy reflect two different governance paradigms. Their interaction creates both opportunities (interoperability pathways) and risks (regulatory friction) that shape the architecture of digital trade. Together, these theories provide a holistic academic foundation for understanding the structural forces behind India-US digital commerce.

Research Gaps

- Limited integrated analysis combining AI advancement, data governance, and high-skill mobility as joint determinants of India-US digital trade.
- Insufficient empirical sectoral analysis of India's transition from IT services to high-value AI, cloud, and cybersecurity exports.
- Lack of rigorous examination of the trade impact of India-US regulatory divergence on cross-border data flows.

- Scarce quantification of diaspora-driven innovation spillovers and their implications for digital trade.
- Absence of scenario-based models predicting India-US digital trade trajectories toward 2030.

Objectives

- To analyse the evolving structure and sectoral composition of India-US digital trade.
- To assess the impact of AI capabilities on the bilateral digital services ecosystem.
- To evaluate cross-border data governance frameworks and their implications for trade.
- To examine the influence of high-skill mobility and diaspora networks on digital trade.
- To propose a policy framework for strengthening India-US digital trade architecture by 2030.

Methodology

This study employs a descriptive-analytical research design using only secondary data from authoritative sources. Trade data were sourced from the U.S. International Trade Commission (USITC, 2023) [8], BEA (2023), and India's Ministry of Commerce (2023). Digital export trends and skill-related insights were obtained from NASSCOM (2023) [6], McKinsey (2022) [25], and OECD (2022) [18]. Immigration statistics were drawn from USCIS (2023) datasets. Policy analysis relied on official documents such as the DPDPA (MEITY, 2023), USTR NTE Reports (2023), and the iCET Fact Sheet (2023). Academic literature was reviewed to contextualize findings within digital trade theory, data governance frameworks, and global value chain analysis. Descriptive statistics, trend evaluation, comparative analysis, and qualitative document interpretation were used to analyse trade patterns, regulatory shifts, and mobility dynamics. This mixed-method secondary approach enables a comprehensive synthesis of technological, regulatory, and human capital influences shaping India-US digital trade.

Data Analysis

Table 1: India's Digital Services Exports to the U.S. (USD Billion)

Year	USD Billion
2019	54.3
2020	57.7
2021	66.0
2022	74.2
2023	85.0
2024*	92.1 (estimated)

(**Sources:** NASSCOM 2023; USITC 2023) [6, 8]

India's digital exports to the U.S. have grown at a compound annual rate exceeding 11%, demonstrating a shift toward AI-enabled, cloud-based, and cybersecurity services (NASSCOM, 2023) [6].

Table 2: Sectoral Share of India's Digital Exports (2023)

Sector	Share (%)
Software & IT Consulting	36%
Cloud & SaaS Services	22%
AI/ML & Data Analytics	14%
Cybersecurity	8%
BPM/ITES	20%

(**Source:** NASSCOM 2023; McKinsey 2022) [6, 25]

This composition reflects India's movement into higher-value digital services as documented by McKinsey (2022) [25] and OECD (2022) [18].

Table 3: Indian Share in H-1B Approvals

Year	Share (%)
2018	74%
2019	72%
2020	75%
2021	76%
2022	73%
2023	68%

(**Source:** USCIS, 2023)

These numbers demonstrate a persistent dominance of Indian digital talent in the U.S. labour market (Kerr, 2018) [11], reinforcing bilateral digital trade linkages.

The data collectively indicate that technological complementarities, mobility-driven knowledge flows, and expanding AI capabilities are central to the bilateral digital ecosystem. However, regulatory divergence around data flows introduces uncertainty, affecting sectors like fintech, health-tech, and AI training data an issue widely discussed by Aaronson & Leblond (2018) [1], Chander (2021) [12], and Singh & Rajan (2021) [23].

Data Interpretation

The data indicates a clear structural shift in India's digital export profile. Between 2019 and 2024, the share of traditional IT services declined from 42% to 36%, while high-value cloud, AI, and cybersecurity segments expanded rapidly. The estimated 2024 digital export value of USD 92.1 billion reflects the maturation of India's SaaS ecosystem, with over 25 Indian SaaS firms surpassing USD 100 million in ARR many serving U.S. clients. This suggests that India is no longer just an IT outsourcing hub but an emerging co-developer in sophisticated AI-enabled services.

Mobility data reinforces this shift. While India's share of H-1B approvals dipped slightly from 76% to 68% between 2021 and 2023, the composition of Indian applicants has changed: demand for cloud architects, AI researchers, and cybersecurity specialists has grown significantly. This aligns with U.S. corporate hiring patterns and supports the argument that innovation-driven services, not cost arbitrage, now drive India-US digital integration.

Finally, regulatory indicators show that the U.S. and India differ substantially on cross-border data governance, which may affect sectors like fintech, health tech, and AI model training. However, both nations have strong incentives to collaborate because large U.S. enterprises Google, Amazon, Microsoft, Meta depend on India's workforce and digital infrastructure to scale global operations. The geopolitical logic is therefore complementary despite regulatory friction.

Discussion

The combined analysis of trade flows, sectoral changes, mobility statistics, and regulatory environments reveals that India-US digital trade is driven by deep complementarities but constrained by policy misalignment. India's rapid transition from traditional IT services to advanced digital segments such as cloud transformation, cybersecurity, and AI engineering matches the innovation demand of U.S. enterprises. High-skill mobility amplifies this

complementarity, as Indian engineers in the U.S. serve as conduits for collaborative research, startup creation, and offshore development expansion. However, regulatory divergence poses friction: India's data protection framework prioritises sovereign control and user protection, whereas U.S. policy promotes free data flows. Firms dependent on transnational cloud operations and data-intensive AI development face uncertainty regarding compliance and operational integration. Despite these challenges, institutional mechanisms like iCET indicate growing political willingness to harmonise technology and trade agendas, suggesting that bilateral digital trade will expand if governance gaps are systematically addressed.

Implications for Firms in India and the U.S.

The findings have direct operational consequences for firms engaged in bilateral digital trade.

For Indian firms, the shift toward AI and cloud services means they must invest in higher-skill talent, proprietary IP, cybersecurity capability, and vertical-specific AI solutions. Companies like Infosys, TCS, Wipro, HCL, and new-generation firms like Freshworks are already repositioning toward platform-based service delivery, co-innovation labs in the U.S., and specialised AI development partnerships.

For American firms, India remains indispensable not merely as a service provider but as an innovation extension ecosystem. U.S. companies increasingly rely on India for end-to-end digital transformation projects, algorithm training, cloud migration tasks, and round-the-clock AI operations. Silicon Valley startups continue to establish offshore development centres (ODCs) in Bengaluru, Hyderabad, and Pune due to a combination of cost-efficiency and talent depth.

However, regulatory divergence especially concerning sensitive data means American firms operating in India must adopt hybrid cloud architectures, enhanced compliance functions, and data-minimisation practices. Both Indian and U.S. companies therefore face a policy environment in flux, making regulatory literacy and adaptability essential for long-term competitiveness.

Future Scenario Analysis for 2030

Based on trade patterns, policy trends, and technology adoption, three plausible scenarios for 2030 emerge:

Scenario 1: Deep Integration (Optimistic)

India and the U.S. resolve many regulatory frictions through a bilateral "Digital Trade Interoperability Framework."

- Smooth cross-border data flows for non-sensitive sectors
- Joint AI research labs established under iCET
- Skilled mobility streamlined through research visa pathways
- Digital trade volume doubles by 2030

In this scenario, India becomes the primary global partner for U.S. firms in AI engineering and cloud infrastructure management.

Scenario 2: Fragmented Cooperation (Baseline)

Trade continues to grow, but regulatory divergence persists.

- Limited data transfer corridors
- Slow progress on visa reforms
- Firms rely on workaround compliance solutions

Digital trade still grows but at a moderate 7-9% annual rate.

Scenario 3: Regulatory & Mobility Constraints (Pessimistic)

Data localisation expands; H-1B approvals decline; geopolitical shocks disrupt cooperation.

- Impacted cloud and AI-based service delivery
- Higher costs for both nations
- Reduced innovation collaboration

In this scenario, India-US digital trade becomes volatile, and firms struggle to scale across borders.

The baseline scenario is most likely unless deliberate policy coordination accelerates digital integration.

Conclusion

The India-US digital trade corridor stands at a critical juncture where technological potential is high but dependent on policy alignment and institutional cooperation. The empirical evidence shows a strong upward trajectory driven by India's maturing digital services ecosystem, the U.S.'s sustained innovation leadership, and a transnational workforce that acts as the backbone of bilateral knowledge exchange. As India transitions into a higher-value digital economy with strengths in AI, cloud architecture, and cybersecurity, the complementarities with U.S. technological capabilities deepen further. The analysis demonstrates that cross-border data governance, AI policy coordination, and high-skill mobility are no longer peripheral issues but structural determinants of digital trade flows.

Looking toward 2030, the future of bilateral digital trade will depend on the ability of both countries to harmonise regulatory standards, institutionalise technology cooperation, and safeguard talent mobility channels. Establishing mutually recognised privacy norms, sectoral adequacy agreements, and joint AI innovation frameworks can create long-term stability. Furthermore, targeted visa pathways for researchers, data scientists, and startup founders would strengthen innovation pipelines essential for bilateral trade. At the firm level, both Indian and U.S. enterprises must upgrade their technological capabilities, compliance mechanisms, and cross-border integration strategies to operate effectively in an increasingly regulated digital environment.

In conclusion, India and the United States possess a unique opportunity to build one of the world's most significant digital trade partnerships. If strategic alignment is prioritised through policy innovation and institutional cooperation, India-US digital trade could become a model for global digital governance and technology collaboration in the coming decade.

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