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Geopolitical and Technological Impact of U.S.-China Rivalry on India's AI, Semiconductor, and Space Programs: A Strategic Response to Emerging Global Challenges (2018– 2025)

[1]Bismillah Nasir

Department of Political Science and International Relations, University of Management and Technology, Lahore.

nasirbismillah@yahoo.com

Abstract

The stand of US and China has created a rivaled competition in technology and geopolitics which has consequently altered the global order. This transition has provided certain challenges and opportunities for India in AI, semiconductors, and Space. For the term of 2018-2025, realism, neoliberal institutionalism, and constructivism are used to evaluate India's strategic decision making. It emerges that India's lack of indigenous semiconductor technology base as well as her alliance with the US, Japan, and Australia have contributed towards the adoption of the Semiconductor Mission. Efficient self-sustaining industrial capability and technology are also needed. At the same time, the National AI Strategy of India addresses the importance of AI ethics for social and economic development. Geographically, India is well positioned in the Indo pacific region to bolster its stance as a global space power which is further advanced by the Mission Shakti and Gaganyaan programs. This paper contribution is an analysis of how India manages competitive relations with both US and China at the same time and how balancing strategy helps them cope with competition as well as strive for self-sufficient technology.

To tackle these challenges, India has become a significant player in the shifting world order and working toward technological innovation and sustained economic growth.

This paper showcases the strategic rivalry between China and the United States and its effect on India's AI and Space Programming and semiconductor technology during 2018-2025. It outlines the steps taken by India to strengthen itself domestically and provides a framework for understanding the overall multilateral policy, so that the dependency on superpowers is minimized. The study adopts a wide array of perspectives, including political realism, neoliberal institutionalism, and constructivism, so as to understand how these challenges are used to benefit India's geopolitical standing and technological independence. The objective of the paper is to deepen the understanding on how India's economic self-sufficiency transforms her into a powerful force with advanced global technology and to demonstrate how her position is enhanced.

Introduction

To begin with, Artificial Intelligence in the recent times has emerged on the surface as a new frontier of unmatched technology with having its spheres ranging from healthcare, to defense sectors. In the annals of history, it has been proven that countries which have successfully adapted and embraced these technologies have emerged as high political powerhouses within the international arena. Keeping in view the current technological landscape is currently

dominated by an unparalleled rivalry between the existing superpower and predicted superpower, the United States and China. The utmost competition between these two is now solely pronounced in the field of space driven and AI based technologies. This specific rivalry is more than a mere array of economic competition but more of a struggle embedded in achieving unprecedented national security, technological supremacy and higher strategic influence across the globe. Since the most vital elements of International Relations include national sovereignty, military capabilities, and economic resilience, thus the way these all could be achieved totally depend on space technologies and AI driven policies in order to develop, deploy and control the elements. This competition between the two superpowers is not affecting only the US and China but is also creating third party externalities across the world. In the past years, both these nations have adopted highly aggressive national policies in order to ensure their dominance in Space and AI. Some of the stringent export controls taken by the United Sates have been focusing on export of critical AI technologies, advanced technologies in the field of computing, and

Semiconductors which have mainly been enacted to pressurize and target Chinese Companies like SMIC (Semiconductor Manufacturing International Corporation) and Huawei.

Specifically, the **Export Control Reform Act (2018)** and similar policies have all aimed to limit China from accessing the key technologies, and utilizing all such developed AI and semiconductor designs by US. Not only this, but the scrutiny by United States has increased to prevent Chinese involvement in the global supply chain, which has thoroughly resulted in the de-coupling of high-tech markets and industries. The disruption caused by these policies have not only affected Chinese access to critical resources, but creating a mass disruption in global supply chain which include a big range of sectors. (Kafura, 2024)

Besides the United States, China has not been sitting behind, rather the response to these pressures was motivated by the keen objective to accelerate its self-sufficiency in technological domain and for that the specific programs were somehow implemented

including **Made In China 2025**, and **China's AI Development Plan (2018),** which were solely based on the aim to gain a superior position and as a leader in advanced technologies and space such as quantum computing, AI, and space exploration. In order to consolidate these plans, China has also taken various state-backed initiatives and specific investment programs in satellite technologies, autonomous based systems, and AI research. Apart from this, there has been a rise in the ambitious space program, led by CNSA (China National Space Administration), which had been seen as not only a measure to achieve scientific advancement but also an ensured opportunity to assert geopolitical influence.

Talking about the geopolitical arena, and amid this technological cold war, there are various countries emerging as critical players in navigating a complex system of their AI and space programs which have to take under account certain limitations and opportunities based on the U.S.-China rivalry. Specifically, India is a nation with high technological aspirations, which is clearly visible in the **National AI Strategy (2018),** the internal elements of the initiative aims to position India as one the global leaders in the arena of space and AI by 2030. Not only this, but India has been seen growing its space defense capabilities with the help of certain organizations like ISRO (Indian Space Research Organization). However, this is where the factor of dependency plays it role, as India's aim to achieve its access to all technological capabilities then solely depend and are influenced by the trade and diplomatic policies of the U.S. and China. Achieving a boosted AI sector critically requires having the ability to access critical semiconductor chips, and these chips are majorly sourced from Taiwan and the United States. Though on the other side, there are ongoing trade restrictions and export controls, and these constraints then also limit Chinese access to these technological components. The whole given scenario is critically forcing Indian to look for alternative suppliers, and there arises the issue as the United States and China are the two nations in today's era having technological superiority. The second alternative for India is to start investing in domestic semiconductor manufacturing.

Talking about the semiconductor or 'computer chips', are the most vital component of all modern technology. China, the world's top semiconductor consumer and the fifth largest semiconductor manufacturer in the world has showcased its sole aim to become an AI leading superpower repeatedly. However, China's top semiconductor company, SMIC and other major tech companies were placed on the US trade blacklist. These sorts of sanctions have limited the ability of SMIC to access key foreign technologies, depriving them from advancing their chip technology. In October 2022, the United States continued to tighten

these trade restrictions and giant tech companies of U.S. have faced several trade restrictions

from selling these chip sales and exports to China. Since China is quite ambitious in achieving its goals, thus these did not stop the advancements of Chinese manufacturers. The SMIC generated and produced various processing chips such as in Huawei which was seen as a competitive contender to nanometer chips produced by Apple. The rivalry was recently further complicated was China impeding and interfering in the U.S. elections, which now many create a shift in policy directions between the two countries, requiring a critical strategic approach keeping in the view the geopolitical dimensions.

Specific effects for India:

India has caught itself in the crossfire rivalry between the two superpowers, yet struggling to crave its path for global influence and technological sovereignty. The foremost problem arising from this rivalry is the shortage of accessing the technology tools, since the semiconductor shortage triggered by the trade restrictions against China has affected India being in a precarious position, having its reliance on imports. However, in order to mitigate these issues, India had to opt for domestic AI development and also took various steps to leverage its partnerships with alternative high-tech countries like Japan. Other than this, the Indian authorities have also introduced initiatives to attract foreign investments, and a major $10 billion incentive plan in 2021 to build semiconductor manufacturing plant, with the sole purpose of ensuring self-sufficiency, and reduced dependence on foreign imports. Along with this, India has been actively involved in advancing its space technology such as developing highly sophisticated satellites, and successful demonstration of its own Mission Shakti test in 2019. The existing technology war between the United States and China has compelled to also maintain ties with other traditional partners like Russia to avail collaborative space missions. India also took critical participation in Quad space security incentive with the United States.

In the domain of Diplomatic relations and to strengthen the strategic responses, India has actively participated in various multilateral forums which focus on AI governance, cybersecurity and space security. India has also been participating in initiatives like Artemis Accords which focuses on ensuring peaceful space exploration. This supports India to strengthen its position as a key player in the Indo-Pacific.

Historical Background & Discussion of the entities

According to the lens of history, the rivalry between China and United States formally started intensifying during the Trump Administration which was between 2017-2021, and that took a sharp pivot towards a trade war only a year later in 2018. Initially, the United States began accusing China of unfair trade practices, excessive government subsidies provided to Chinese tech giants and also for intellectual property theft, which eventually led to it all contributing to an immensely growing economic trade imbalance. In the recent years after this trade war had started, United States started getting concerned with the growing Chinese technological capabilities which were seen particularly in AI advancements and 5G, along with the latent Chinese ambitions under the economic project of Belt and Road Initiative. This mere rivalry then started escalating into a wider military and technological competition in 2018, as United States intended to curb the technological ambitions China had, and for that reason, United States imposed sanctions on Chinese companies such as Huawei.

India, which was not a direct part of this trade war, gradually became a key player in the broader geopolitical aspect. The initial involvement is believed to be more reactive than being proactive in nature, as India was one of the few nations openly opposing and rejecting participation in the context of China's Belt and Road Initiative, and expressed concerns related to growing influence of China in its neighborhood. Specifically, this is the region where India had maintained strategic influence. (Kennedy, *U.S.-China relations in 2024: Managing competition without conflict*)

Simultaneously, where India was showing distress and concerns regarding Chinese ambitions, it aligned itself with the United States through multilateral initiatives. Gradually, as a result the U.S.-China rivalry began to direct impact India's technological and economic policies as well. India sought to achieve an opportunity to boost its tech infrastructure, particularly with the help of Ai based tech, semiconductors and space expedition and as United States was already taking aggressive sanctions and constraints to contain China's rise in technology, India sought out to make way as a neutral. Though in the early stages, India had mostly centered around economic diversification, only distancing itself from the Chinese technology companies between 2018-2020. However, in the later years, the United States began to pressurize for a more robust Indo-Pacific strategy and that also entailed a stronger partnership with India, and that is how India joined the Quad forces sin 2019, with ensuring strategic autonomy for itself and also aiming at counterbalancing Chinese growth in the region.

The incident of Galwan Valley Clash, which happened in 2020 was an intense conflict where Indian and Chinese forces faced clashes along their disputed borders, and that market a significant turning point in the ongoing trade rivalry. Though India had been wary of rising power of China, this specific incident shaped Indian public opinion against China. Since India being a democracy vows for its norms and identity, and as a response India later strengthened its alignment with the United States and Japan as a key point to assure regional security, and also for strategic autonomy. (Gokhale, 2021)

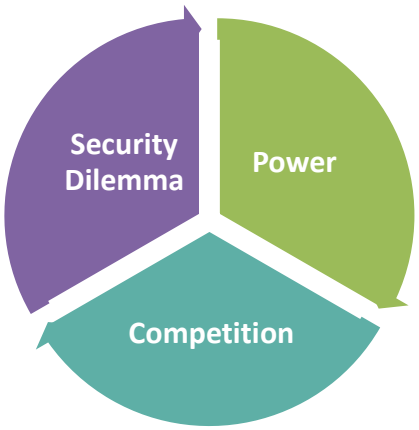
The United States began well. Most of the largest global corporations and universities, like Google, Microsoft, MIT, and Stanford were also on this list that promoted innovation and urged students to participate in AI experiments. On the same account, California's Silicon Valley also emerged as AI pioneers and developed into the AI hub, housing the offices of Meta, Apple, Adobe, etc. However, China was a major competitor and did not fall far from the tree in the technological camp. In fact, the nation had an immediate head start because of its large population which output information that developers can use to teach artificial intelligence applications. Further, it means that China does not suffer from such strict environmental regulations for AI to cost it more than it does for other nations, which is equally the reason as to why the rates of evolution, and subsequently the rates of innovation are higher. The Chinese government has already planned a number of progressive strategies to increase the country as the world's dominant AI power by 2030 as Chinese investors invested in many startups and have also spent a great amount in education platform. These have created a surge to young adults in developing sectors in AI, hence leading to increased development of innovations. (Li & Samet, 2024)

This race started off as quite amicable and balanced, but the two sides have become hostile in the recent the past. A large number of complaints regarding piracy of intellectual property and national security concerns became familiar to the American people. As the FBI made comments on China's bid to allegedly steal technology and information from citizens of America in order to advance their Artificial Intelligence advancement and studies. On the same note, China complained that America seeks to ensure Chinese gains do not make the country the technology powerhouse of the world.

Research Questions

1. ***In what way the China-U.S. rivalry impacted the India's Artificial Intelligence and Semiconductor Strategy.***
2. ***How has the U.S.-China rivalry in space technology and defense influenced India's space programs and its positioning as a global space power (2018–2025)?***
3. ***In what ways the India's technological positioning in AI, semiconductors, and space programs affected its broader geopolitical alliances, keeping in view the specific actions India has taken in order to mitigate these challenges between 2018-2025?***

Theoretical Framework



Developed By Author

- **Realism:** Security Dilemma, Power and Competition

Realism as a theory deep rooted in the sole assumption that all states are significant unitary actors being primarily concerned with the critical motive to ensure survival and securing their own national interests. The belief that the international system is an anarchic system, where only the powerful and fittest survive crushing the weakest. In order to win over the anarchy with power, the states need to state diligent in adapting the evolving policy, and recently technological superiority has become one of the key-factor in national power and security.

Through the lens of realism, the competition between the U.S. and China can be understood in a manner where the international struggle for ensuring technological supremacy is directly linked to global economic and military dominance. A point where both the superpowers have been taking aggressive measures to ensure trade restraints in order to prevent the opposite party to access these semiconductor chips, or any latest technology being related to global supremacy. Other than these, India's response and role in this U.S.-China rivalry can be simply understood as a classic example of balance behavior in the domain in international relations. Now, the basic assumptions of realism would suggest that India at all costs must position itself in the global arena being capable enough to protect its sovereignty as a state, along with regional security in this rapidly changing geopolitical landscape. India has an ongoing border rivalry with China, and then China's advancements in AI and space technology has posed strategic challenges for India. In order to mitigate these challenges, and ensure power survival as per the roots of realism, India's investment in AI development and recent space programs including India's anti-satellite missile tests do reflect a realist approach

since the missile program can be seen directly as a direct response to China's growth in space related military capabilities. The concept of Balance of Power, and Security dilemma as an under-account within realism, suggest any significant unitary actor within the anarchic realm will undertake evolving measures and initiatives in order to keep their power morale high, if sense of insecurity arises from any other state. India is affected both by the U.S.-China AI and Space warfare, and China's growing technological influence and thus in order to maintain

a balancing strategy, India maintains memberships withing traditional Quad partner to counter China's influence as a regional influence in the Indo-Pacific region.

- **Neoliberal Institutionalism/Factor of Dependence**

By definition, neoliberal institutionalism is solely built upon a premise which explains that while all states are the primary actors within the international anarchy, and all states aim to achieve higher sovereignty and ensured power along with survival, there is also a possibility which remains persistent that apart from all this reality, states can also cooperate in order to achieve their mutual interests and this is where the factor of dependence comes in. Since the global system entails interdependence, also explained in the Cobweb model of international relations. Unlike realism, which posits the emphasis on conflict and competition, neoliberal institutionalism then highlights the key role played by international organizations, trade relations and technology transfers between the entities as the eminent mechanisms by which the states can collaborate to enhance their desired welfare within the system of global governance. In this specific context, neoliberal institutionalism highlights the nature of global technology supply chains being interdependent in nature. Despite any sorts of conflict, the three entities have between each other or in common, India continues to rely on both the two superpowers for various elements ensuring its technological growth. Also, despite the geopolitical tensions, India still has to depend on Chinese semiconductor imports, and also leveraging its partnership with United States through multilateral forums within the domain of AI governance and space tech. This would perfectly relate to the this given concept of neoliberal institutionalism, as these multilateral forums and the system of trade do overpower the basic concept of realism, as through these specific partnership programs, diplomatic ties, or trade, India gains access to advanced technologies, which help its state-based goals of building technological capabilities and space defense systems, and all these achievements while maintaining a specific degree of autonomy vis-à-vis China.

- **Constructivism**

Developed by Author

Constructivism as a theory putting all emphasis on the role of norms, ideas, perceptions and identities, as key players in shaping the behavior of states within the global realm. The basic

concept arises from the element of epistemology and ontology, and the belief that all elements in the given world are socially constructed and fabricated. In detail, it is also believed that all actions taken by states are not just a mere product of their material interests like security and power or cooperation, but mainly by the elements of social constructions within a society such as identity, norms and culture. This emphasizes that all these factors will majorly contribute to the way states define themselves, achieving their national objectives and their role in the international system of anarchy shape the foreign policy behavior. As the international system is dynamic, so will the behavior of state will be depending on changing norms and ideas over time. Specifically for India, identity plays a key role in the geopolitical and technological responses against the U.S.-China rivalry. Since in all formed constitutions and initiatives, India views itself as a democratic power with a firm commitment to achieve ethical technological advancements. Since the belief in democracy is strong enough, India maintains trade and semiconductor imports from China, and also aligns itself with the U.S. and other democratic powers which distinguishes itself from Chinese authoritarian approach to accessing giant technology. This is why, India's National AI Strategy tend to prove the concept of norms and identity playing a critical role, which is seen in vows to undertake ethical AI Applications, and proving itself as a responsible democratic power despite the ongoing technological warfare between the two superpowers being totally opposite in the modes of governance, United States a democracy and China being an authoritarian state.

Literature Framework

- ***National AI Policy/Strategy of India and China: A Comparative Analysis*** (Kumar, 2021)

  The article includes the emphasis on Chinese initiative taken in 2017 -**New Generation of Artificial Intelligence Development Plan** – which is a comprehensive strategy solely aimed at ensuring a country established as a global leader in AI by the next decade. This plan specifically focuses on AI as a critical driver for amplifying the Chinese national security and competitiveness, which is a leap forward from digitization to intelligentsias, across various sectors within its borders and the core focus also revolves around the objectives to achieve breakthroughs within the AI technology, more specifically in order to create a systematic approach to carry out smooth research, development and market-oriented product development.

  Keeping in view the strategic goals, this initiative was set with clear timelines. By **2020**, China had aimed to match up its AI Technology effectively in line with the global leaders who had already achieved high tech resources. This plan had targeted a **RMB 150 billion** in core AI industry, and an additional amount of **RMB 1 tr**illion in related sectors. Since this plan had leaps of five years in between, so China sought to achieve breakthroughs in AI transformed industries aby **2025**. Lastly, it had also aimed to solidify its position as the world's largest AI innovation center with high tech AI industries, semiconductors, and technological weapons, ultimately proving itself as a global AI leader by **2030**. Though there are constraints and limitations on trade of semiconductors, yet China has taken enough measures such as promotion of world-class AI research, collaboration, promoting enhancement in high-end computing infrastructure and integration of AI in military-civilian relations in order to facilitate dual-use of technology between defense and civilian sectors. However, being an authoritarian regime, it also stresses on the development of ethical frameworks, AI-related laws and cybersecurity regulations. Since it is the anarchic world, China not

only aims to achieve technological supremacy but also to secure its position as a leader in global governance.

The interplay brings India to the ground as well, where the Indian National Strategy on AI which was introduced in 2018, emphasizes on leverage the technology, space driven initiatives and AI for inclusive social development and economic growth, also to maintain its supremacy as a regional leader in the Indo-Pacific region. In descriptive terms, India's approach revolves around one vision of AI for All, which then focuses on entailing all sectors like healthcare, education, agriculture and transportation rather than a mere pursuit of high boom in economic growth. The sole reason why India has to rely on semiconductor chips import is because India envisions itself as an AI garage which would develop scalable AI solutions suitable enough for rapidly changing national and international environment. The strategy defined in the specific literary work does not specify any financial allocations, but a budget of **INR 1200 crore** has been identified for a National AI Mission (N-AIM).

This strategy sought to prioritize the application of AI in five key areas: Healthcare, where the improved access for everyone and affordability can be ensured; education, in order to ensure improved quality and access. Other than this, the concept of smart cities based upon the improved infrastructure, urban development and smart transportation for easy mobility, along with enhancing efficiency and safety. For this very reason, India has opened up research centers and platforms to secure self-sufficiency such as Centers of Research Excellence (CORE) and also providing incentives for AI startups and workforce training.

Apart from the characteristics in the AI strategies and initiatives taken in both China and India, there is a commonality in terms of highlighting the need for an appropriate intellectual property regime, with enough ethical guidelines and the principles to ensure the responsible usage of AI to advocate for accountability, transparency and fairness. India specifically carry out its own norms and identity being a democratic state, stressing out the importance of global collaboration within AI governance and ensures that it actively participates in the AI standard-setting including the policy discussions and forums internationally. (Kumar, 2021)

- ***The US-China Trade War: Costs, Causes, and Potential Responses by Tier II Powers*** (Ciuriak & Dan, 2018)

In the given timeline of 2018, there has been a rapid escalation in global trade war between the two superpowers; United States and China and that has specifically marked a quite significant shift in the economic and political landscape internationally. In the annals of history, this conflict between the U.S. and China is relevantly compared to Anglo-German rivalry which led to the first world war. This creates concerns about the growing influence of China within the global governance, which particularly increased since its accession to the World Trade Organization.

Although China is witnessing increased exports and high technological advancements, and that has made it a critical market for global investing firms, including the major U.S. companies like Apple, still the government of United States is motivated by more than a mere pursuit of economic grievances. The supposed catalyst for this trade war is most likely the recent technological driven revolution which includes the supremacy in AI, machine learning and big data. Since the nature of the international order is dynamic, and in the current era the new technology driven interests are playing their role in reshaping global economies, and creating new grounds for geopolitical and geostrategic rivalry. The tensions which have been going on between the United States and China have both used regressive trade measures, but besides that both the countries have also used monetary and fiscal policies to mitigate the effects. Though these steps have created long term risks, especially because the equity markets in both the countries have suffered due to the decline in foreign direct investment, particularly in terms of in economic stability and inflation, eventually resulting in the growing uncertainty in the global economy.

The article suggests that the causes of this ongoing trade war are complex, as some view it being a part of an unavoidable geopolitical struggle between an established hegemon (United States) and a rising power (China) and as the concept of hegemon stability theory reflects that a shift in hegemon transition is hardly smooth or peaceful, rather chaotic. Thus, there can be many factors including the political governance system of China, intellectual property concerns, the Chinese role in U.S. de-industrialization. The response of United States can never be judged or explained by these factors alone, as the sole factor which is more significant and often overlooked is the role that technological innovation plays in the dynamic international system, particularly in the digital economy. Since the importance of data as a form of capital is now a crucial factor in creating economies of scale along with network externalities, it

often makes technological dominance a key player in investment policies globally and the global supply chain system.

The same sort of rivalry had occurred previously between United States and Japan in the previous decades, particularly in the 1980s and especially in sectors like memory technology. Though the current U.S.-China trade war shares some sort of similarities with the earlier rivalry, with one key difference. The distinction was that the rivalry between the United States and China was purely economic in nature, whereas the rivalry between China and United States revolves more around the strategic military concerns which further entail the concerns over dominating the big data, space driven advanced technologies and also, AI supremacy, which somehow positions the two states akin to Cold War between Soviet Union and United States. The geostrategic measures taken by both the states are aggressive in nature, and lead to a series of technological denials such as the trade restrictions against Chinese companies, particularly Huawei from having access to highly crucial technologies.

Not only this, but the United States has also showed its presence in countering the Chinese economic initiatives like Belt and Road initiative, along with the growing Chinese influence in regional and international institutions like Asian Infrastructure Investment Bank. There are various quad forums and multilateral agreements such as the Canada-United States-Mexico Agreement now officially included clauses which act up as warnings against initiating any trade deals with China. In latent meaning, these warns and clauses indicate the objectives of United States to disrupt China's ability in forming any independent trade alliances, and accessing the newer semiconductor chips and AI based technology. Based on all these factors, this automatically suggests that this geostrategic and geopolitical rivalry is beyond a traditional economic and trade dispute, and also indicating how the global trade may be organized in the future between the superpowers, along with creating crib effects for other states in the international realm. (Ciuriak & Dan, 2018)

- ***The US–China Trade War: Impact on India and Other Asian Regions*** (Chaddha et al., 2021)

India, being the third-largest economy in the world solely in aspect of purchasing power parity (PPP), which came as a factual figure in 2018, has undoubtedly undergone various economic transformations in recent decades. Indian economy became liberalized in 1991, and ever since that liberalization happened, India has enjoyed consistent economic growth patterns, nearly averaging 6-7% on annual basis. From the year 2014 onwards, India has surpassed China in terms of growth, which ultimately makes it as the world's fastest-growing major economy. Although the major sector of this growth has been driven by an expansion in the services sector, with experiencing dynamic patterns in terms of agriculture's share of the economy overall. India's Gross Domestic Product has various domains where the manufacturing sector has been stagnated, contributing only 16% of the total GDP. This has raised questions on the country's industrial since 2000, up to 2018. Not only the questions about the manufacturing bases have been raised, but also regarding its ability to integrate itself into global value chains. Due to the decline in manufacturing exports, and experiencing a rise in imports on the other hand has led the need to ensure value-added growth in manufacturing in order to be able to integrate within the global markets. For this sole purpose, India has launched the **Make in India initiative back in 2014**, which entailed the objectives regarding turning the country into a global manufacturing hub. This initiative taken specifically focuses on bringing a growth in contribution of manufacturing sector, along with creating 100 million jobs which would boost both the foreign and domestic investment, and innovation. Though India has taken this initiative, the challenges persist due to this ongoing trade war between the United States and China, because the Make In India initiative was initially started in a peaceful trade agreement, which has now been disturbed due to the rise in protectionist policies and the rise in tariffs in between the trade from these two countries. This has moreover involved India into tariff escalation along with disrupting global supply chains, especially in electronic, technological and chemical sectors. Here comes a dilemma for India, though the global trade provides and offers significant opportunities to benefit from, but side wise it creates a crucial uncertainty which has been affecting investment flows along with trade relations, all in negative manner.

There has been ongoing concerns related to Make In India initiative that it could be adversely affected by the ongoing trade war, and thus the main focus is now shifted to

attracting investment and strengthening technological giants, along with an

improvement in industrial bases. On the other hand, the protectionist policies being carried out by both the superpowers have been creating ambiguous effects for India, since it has to rely on both the U.S. and China for importing technological elements so all these measures somehow limit the trade opportunities, creating barriers for both imports and exports for India. The article also includes earlier literary studies carried by Johnson (1953), Bagwell and Stagier (2002), and others who have thoroughly analyzed the strategic aspects of these ongoing trade conflicts, and every work has more or less focused on an optimal tariff setting and studying retaliatory trade measures. Some other works carried out recently in the given time frame, Bouet and Laborde (2018) has critically analyzed the retaliatory actions taken by the trade partners, and an emphasis on how the countries can gain or lose from these increased tariffs, trade restrictions on technology and economic positions globally. While the initiative 'Make In India' and National AI Strategy undoubtedly entail the potential to drive the technological advancements, along with industrial growth but all other global factors are creating massive complications in achieving these objectives to ensure Indian presence as a global and regional AI leader in the near future. (Chaddha et al., 2021)

- ***Sino-US Trade and Trade War*** (Kashayp, & Bothra, 2019)
  This article also highlights the uncertainties and disruptions which have been created due to the geostrategic trade rivalry between United States and China, which has not only affected the economies of these two nations but also has contributed in providing an array of opportunities and challenges for states across the globe, specifically India. Not the technological restrictions solely, but the United States has also imposed restrictions including tariffs on the Chinese goods, with an intended attempt to address intellectual property concerns and trade imbalances side by side. The trade tensions have been quite visible in the trade market for Apple, which is a major U.S. based company. Now, Apple experienced a straight 15% drop in sale of iPhones in China in the last quarter of 2018, which was partly due to the trade tensions.
  Likewise, when the trade restrictions were imposed on the Chinese goods, American consumers also faced higher prices.

Other than the mere economic pursuit, China has relied on the United States and allies for imports of high-tech elements. Though China has been a formidable player in the global tech markets, and has been adaptive to rapid innovations over time such as Artificial Intelligence and space driven initiatives. However, despite all the adaptive measures, China still has to rely on the United States for certain AI based technologies as it aims to be a dominating power by the year 2030 in the global landscape. Since both the nations vie for leadership in the digital era, the conflict remains vital to both. The adverse effects of the trade war have been intensified and witness when many companies have been seen shifting their production bases from China to mainly Southeast Asia, and countries like Thailand, Vietnam and Malaysia are benefitting from this transition. Though the United States has also diversified its sources of imports, which did provide many opportunities for other economies as well. This was surfacing in the UNCTAD, where countries like Japan, Canada and European Union are all poised to gain. (Brazinsky, 2023)

Specifically, according to strategic opportunity, the United States seeks alternative suppliers and this is where India stands to gain but in sectors like textiles, leather, gems and auto components. Since the trade restrictions against China have led to Chinese products becoming more expensive in the United States, so Indian companies are benefitting from that situation, which is somehow and opportunity to enhance the potential of its ‘Make in India’ initiative by improving the competitiveness on Indian manufacturing and industrial bases, while also focusing on its National AI Strategic program. Though this articles also entail the strategic steps for India to improve the AI driven national interests along with export competitiveness. The programs like Sagarmala and Bharatmala are supposedly moving in the right direction, but the Indian government must also take particular steps to quicky capitalize the shifting global supply chains and fostering both the domestic and foreign investment indexes. There are various opportunities to gain from during this ongoing war, but the limitations are also as high, since the war is majorly all about technological supremacy in the global governance, and this is where India stands firm as well, having the same motives as United States and China, and that is, enhancing its own tech giants in order to carry out a significant pursuit of highly advanced policies and AI based societies to prove itself as the global leader. (Kashayp, & Bothra, 2019)

Answers to Research Questions

- ***China-US Rivalry impact on India's Artificial Intelligence And Semiconductor Strategy:***

Semiconductors:

Semiconductors are necessary to contemporary economic es and serve as the foundation for wide range of parts, including artificial intelligence, electronics and space exploration. The United States of America and China are involved in complex competition for semiconductor production. China always wants to create its own independent semiconductor zone, while the United States of America wants to keep control of the semiconductor supply network. The government of US limited access to breaking edge semiconductor advancement in 2021 by impose export limitation on Chinese tech organizations like Huawei. National security concerns motivated this commitment because China could utilize their technological advancement for military purposes and for spying. This decision source a technology disagreement and severely damaged at the the international semiconductor unit. India's semiconductor industriousness, which is generally interdependent on American and Chinese technologies, has put it in an insecure posture. The need for semiconductors in India is rising, especially as the artificial intelligence sphere rise and smartphone rise. All the same, its supply unit is now undefended as an outcome of its dependency on imports, especially from Taiwan and South Korea.

Make in India campaign: To deal with these issues, India has started a number of programs to encourage native semiconductor manufacture. In ordering to create a powerful semiconductor system, the Indian government's Semiconductor Commission, which was disclosed in December 2021, program to commit more than ₹76,000 crores, or almost $10 billion. This consider support for designing scheme and chip manufacture installation.

India has also reinforced its ties with the Japan and United States, two states that have a strategical involvement in shifting the international semiconductor supply chain away from

China. A central element of this plan of attack is India's cooperation with TSMC (Taiwan) and Global Foundries (U.S.) in the beginning of semiconductor complex in India.

Data Centre Growth: The need for semiconductors is right away related to India's driving force to build cloud structure and data Centre. Grand View Research projects that the Indian semiconductor industry will spread out at a compound annual growth rate (CAGR) of 22.7% between 2021 and 2028, which is in line with the state's tendency to get little interdependent on external sources.

AI:

The United States and China are in a ferocious rivalry for technological domination in artificial intelligence. Western states are afraid by China's AI-powered surveillance method and its usage of AI in both the commercial and military spheres. The government-of US has responded by footstep up its attempt to assist its data safety, invention, and AI investigation programs.

India's AI Strategy: The National Institution in 2018 for Transforming India (NITI Aayog) discovered India's National AI Plan of action with the goal of making the state a better military unit in the AI industry. The authorities has set up a number of programs to assist AI research, educational activity, and business enterprise uses because it recognize the potential of AI to modify its economic system. Data Sharing & Security Concerns: India faces challenges in equalization the unethical and safety concerns in AI improvement. The U.S.-China competition has highlighting hazard related to data isolation and the use of AI for surveillance. India has made indefinite quantity in rising its AI administration by linguistic communication agreements like the India-U.S. Strategic AI Partnership, which centering on encourage ethical AI, cooperative research, and AI modular.

Strategical Consequence:

India's AI Research and Development (R&D) strategy has progressively adjusted on self-direction, while also guarantee that it remains incorporate within worldwide technical scheme. The Indian authorities is investment intemperately in AI research hubs such as those in Bangalore and Hyderabad, which are positioned to be international leadership in the improvement of AI resolution.

India's AI argumentation also emphasizes gathering indigenous AI utilize for critical sphere such as health care, commercial enterprise, defense, and education. This is part of a wide plan of action to create native technologies that can be used to adoptive national technical self-determination.

Key Data and Examples:

In 2020, India's AI securities industry was valued at $7.8 billion and is proposed to grow over to $38.9 billion by 2025 (a CAGR of 36.9%). This display India's fundamental impulse in this sphere. The Semiconductor Nongovernmental organization is anticipated to make over about 35,000 jobs in the semiconductor sphere, making India a significant participant in the international supply chain.

Conclusion for Research Question 1:

The U.S.-China rivalry has essentially attribute India's technical policy over the past few years. In the semiconductor and AI sectors, India is strain for technical dependency while at the same time collaborating with major international powers. India's self-reliance activity (through with the Semiconductor Mission and AI Strategy) reflect the state's strategical consequence to the geopolitical and economic situation unopposed by the China-US rivalry.

- ***How has the U.S.-China rivalry in space technology and defense influenced India's space programs and its positioning as a global space power (2018–2025)?***

In the specific time frame, where India has already emerged as a space-faring state with having an immense focus on institutions like Indian Space Research Organisation is compounded with space security along with technical dependency, especially in the sectors of space defense and satellite communications. This has been precedented with specific initiatives taken by India, such as Mission Shakti in 2019. India carried out a successful anti-satellite missile test in March 2019, which undoubtedly contemplated India's space defense capacity and contributed in positioning India into the sole group of a few states which are capable enough of conducting ASAT tests, and it also highlighted the self-assertiveness portrayed by India. Not only the mission Shakti, but India has also carried out Gaganyaan Mission which showed its contentedness towards space expedition, which also aims to send humans to space by 2025. The mission was not solely carried out to achieve a technical objective but also to place India as a global space power in the international anarchy.

Though this was more of a response to Chinese space capabilities in the recent years. Chinese National Space Administration has located China in an inevitable competition with both the United States and India, there were ASAT tests from Chinese sides in 2007, along with China enhancing its military potentiality through various missile schemes such as Dongfeng-41 missiles. These capabilities were a direct question to U.S. dominance in space security. The space expeditory measures taken by India were seen as a response to Chinese ambitions.

Besides this, the relationship of India with the United States has been quite strong, especially because of the multilateral forums and programs such as the India-U.S. Civil Space Agreement and other collaborations based on space-based defensive measures. India's engagement in the Quad security dialogue including Japan, Australia, U.S. as the critical players proves to be the evaluation of India valuing the space offence and security in the Indo-Pacific region. India has been increasing its space budget as well, as the Indian Space Fund rose up to an average figure of $1.8 billion in 2021.

- ***In what ways the India's technological positioning in AI, semiconductors, and space programs affected its broader geopolitical alliances, keeping in view the specific actions India has taken in order to mitigate these challenges between 2018-2025?***

As seen, India has been increasingly involved in enhancing its technical ability in AI and space programs, but due to the ongoing trade rivalry, India has faced disruptions in the imports of technological requirements. Thus, in order to ensure self-sufficiency and smooth continuation of Indian national objectives in the domain of AI and technological supremacy, India has subtly positioned itself as a counterpoise in the Indo-Pacific region. Alternative to Chinese imports of Semiconductor chips, India has rather prepared key alliances with the United States, Russia, Japan and Australia. These multilateral forums assist India in ensuring secure technical movements, and economic partnerships which at the same time reduces India's dependency on China for high tech imports. With this Quad Alliance specifically, India has gained enough access to edge-breaking technologies in terms of AI based improvement and space expedition. For instance, these Quad members signed a joint agreement based on cooperation in space exploration as the critical topic. Other than this, getting way forward in the world of AI and semiconductors, has somehow gathered India in integrating into a strategical relation with the United States. As of the given time period, the

United States has become a central partner in supplying India with semiconductor technologies, as well as facilitating India's engagement in the international standard-setting activity specifically related to AI tech. For example, the strategic relationship between the United States and India immensely stresses on surrogating effective collaboration in AI research and innovations which would deliver the national interests and affairs, such as health care, space exploration, educational facilities and environmental factors taken under account. The bilateral cooperation with Japan solely depends upon Japan's capability of having AI tech and semiconductors, which for obvious reasons make it a natural ally for India. Due to the shared goals and interests, both the states have joined forces based on objectives such as the integration of AI in various sectors including AI for adversity governance, AI driven agriculture, and all other elements of an inclusive society. (Kumar, A. 2010)

Conclusion

Therefore, India's approach towards the interference of geopolitics and technology of the competition between the US and China from (2018 to 2025) has been both smart and survival instinct, because while engaging in the rivalry of two superpowers, nation also requires to safe guard its future apparatus of technology and geopolitics. While the rivalry advanced, especially, the trade wars and technology breakup, India placed itself on the center stage of contending dominant and emerging powers whilst seeking its strategic independence. For India, the rivalry was the most vividly expressed in the participation in the regional security arrangements, such as the Quad, which pointed to India's shifting loyalty in the continent from China towards the U.S. The Galwan Valley clash of 2020 can be seen as a wake-up call for India to a hostile China and has led to intensification of defense and security cooperation with the United States and other partners. Similarly, the cube-age war of the technologically advanced nations namely the US and China in the fields of AI, Semiconductors and Space gave a perfect platform /opportunity to India to come up in these respective fields. India aimed for getting technological independence and to play a significant role in semiconductor and AI industries to achieve economic independence and technological sovereignty status. India has emerged as a key- actor in these spheres by 2025 as the nation adaptively react on the world scene, empowered by the continuous clash between the U.S. and China.

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