

Historical Narrative of India's STI Journey: Challenges and Opportunities

Anu Unny

Department of Political Science, University of Kerala, Thiruvananthapuram, India

*Corresponding author:
unny.anu@gmail.com

Submitted: 4th Dec 2019
Correction received: 2nd Feb. 2020

Abstract

Science, technology and innovation have played an instrumental role in India's nation building process. The development of STI has positively influenced the quality of life of people and in fostering the economic growth of the country. The evolution of science and technology in India cannot be viewed in isolation, but only as an outcome of the larger socio-economic and political processes. The development of science and technology starting from the Nehruvian era to the present Modi era is a reflection of the larger politics played out in the country. If state was the main driving force in the development of science and technology in the first phase of independence, with the introduction of neo-liberal reforms in the 1990s, private sector also began to play a major role in shaping the outcomes of STI. Nevertheless, inadequate funding for research and innovation, withdrawal of public sector from investing more in STI, inaccessibility of the common man to the latest technological outcomes, absence of democratization of science and its over politicization are posing new challenges for the development of science in the contemporary era. Science is yet to liberate itself from the clutches of elitism and hegemony. If India has to address the existing inequality in STI, it is pertinent to take deliberate efforts to make science more inclusive, accessible and affordable for all in the country.

Keywords: STI, India, Nehru, Manmohan Singh, Indira Gandhi, Rajiv Gandhi

© 2020 Perdana Centre UTM. All rights reserved

■ 1.0 INTRODUCTION

The significant achievements India made in Science, Technology and Innovation (hereafter STI) has immensely influenced the country's march ahead to become one of the key players of global economy and politics today. The history of science started from the ancient period and evolved through the colonial and post-colonial period is entering into a new stage wherein new discourses on science and politics are emerging. The phenomenal growth that science has marked in different fields including the health sector, nuclear technology, defence sector and space technology are shaping India's development trajectory. However, to what extent these scientific achievements are actually benefitting the common man is a point of enquiry.

In post independent India, the evolution of science started from the Nehruvian era has gone through many ups and downs. In the initial stages of scientific development in India, science was perceived as something that challenges the religion and religious beliefs. Scientific temper was almost absent in the initial years of independence. Though seventy-two years have passed since India gained independence, even today the conflict between science and religion has not settled. This conflict between the two to some extent is hampering the progress of science in the country at different levels. Poor infrastructural facilities, scarce resources, cutting of funds for scientific research, low public and private investment in innovation, systematic attempts to undermine the autonomy of scientific institutions, general

backwardness of the economy, dependence on technology from outside etc are some of the several challenges that the STI in India is facing at present. The purpose of this Article is to throw light on how STI has contributed to India's overall nation building process and how STI has evolved over the years under the patronage of various Prime Ministers of the country. As the world is stepping into a new age of digital governance, science and technology studies are of crucial importance today.

The issue to be problematized here is that, in the west, while STI paradigm remained relatively autonomous and free from the domain of politics, in India, it is the state apparatus and politics that regulates the outcome of STI. It is a fact that science and politics are intertwined in the Indian context and in many occasions, politics has gone to the extent of challenging the legitimacy of science and undermining the credibility of scientific institutions for catering to their narrow political goals. This Article looks at how state leadership has influenced the course of scientific developments in India and how state itself is becoming a constraining force in the growth of STI. Another objective is to understand the present-day challenges to the development of STI in India and the ways to overcome it.

This Article is a brief historical account of India's STI journey so far. It intends to assess the contributions of Prime Ministers starting from the first Prime Minister of the country Jawaharlal Nehru to the current Prime Minister Narendra Modi to the promotion of science and technology. The evolution of science and technology over the past several decades in India and contemporary challenges to the advancement of science would be discussed in brief in the course of the Article. This Article is structured into 6 parts. The first part is general introduction to the theme. In the second part, first phase of the evolution of science and technology, that is the Nehruvian contributions to science, is explained. The third part is on the contributions of Prime Ministers Indira Gandhi and Rajiv Gandhi towards the promotion of science and technology in the country. In the fourth part, an initiative of Prime Minister Manmohan Singh to the current Prime Minister Modi is mentioned briefly. The fifth part is on the scope and challenges to STI in India. The final part is the conclusion. The methodology adopted for writing this Article is historical and analytical. Primary and secondary sources have been used for writing this.

■ 2.0 PHASES IN THE EVOLUTION OF STI

There are various phases in the evolution of STI paradigm in India. The first stage of scientific development in India began from 1947 and continued up to the late 1960's was a period predominantly influenced by the significant contributions of the first Prime Minister of the country Shri. Jawaharlal Nehru. In the second stage started from late 1960's to 1990's, Nehru's daughter Indira Gandhi and her son Rajiv Gandhi played decisive roles as Prime Ministers in promoting STI through various initiatives. The third stage which started from 1990s is marked with the introduction of a number of neo-liberal reforms under the prime ministership Narasimha Rao and later on followed by the Manmohan Singh Government.

One of the major challenges in the first phase of scientific development was how to develop scientific temper among people in a religiously blind society like India and how to build institutions for science and technology governance in the country. Science was viewed with suspicion by various religious groups. Nevertheless, in a later stage, things started to evolve gradually when people began to see science and religion as two separate entities due to the positive intervention of certain progressive science-based movements. Even today, there is a tendency to view science as an elite discipline that excludes human beings from the purview of it.

When one revisits the STI journey of India so far, indeed, the technological advancements the country has made have influenced the traditional Indian society to travel to a modern society. Innovations in the field of science and technology have influenced India's governance patterns, lifestyle, outlook and vision. With the growth of science and technology, perception about development itself has undergone a drastic change. On the one hand while science was viewed as a solution for all the problems the mankind was facing, on the other hand, a section of people even today viewing it as something that disrupts their normal life. These contradictory perceptions were evident when Nehru the first Prime Minister of India decided to build dams in the country. For Nehru, dams were the temples of modern India. While a section of people viewed the building of dams as a landmark in India's progress to a modern nation, some others looked at it as an evil that troubles their entire livelihood. Their concern was all about the submergence of their villages due to construction of these dams and the forced evacuation from their own land. The construction of Sardar Sarovar Dam across Narmada River was a strong case of protest in this regard. The Narmada Bachao Andolan Movement launched by well-known environmental activist Medha Patkar initiated new debates as to the linkage between science, technology and society. Today, Science and Technology Studies (STS) have developed as a major interdisciplinary area of research.

■ 2.1 Period from 1947 to 1960's: The Nehruvian Era

It was the first Prime Minister of India Shri. Jawaharlal Nehru who laid foundation stone for the development of science and technology in India. Nehru's upbringing, western education and inquisitiveness for science had persuaded him to develop scientific solutions for India's various problems. It was Nehru (1946) who introduced the term „scientific temper“ for the first time in the country. In the Indian Science Congress held in Calcutta in 1938 Nehru had stated “I realized that science was not only a pleasant diversion and abstraction, but was of the very texture of life without which our modern world would vanish away.. It was science alone that could solve the problems of hunger and poverty, of insanitation and illiteracy, of superstition and deadening custom and tradition, of vast resources running to waste, of a rich country inhabited by starving people” (Nehru, 1976).

Nehru firmly believed that science is rational and it is a solution for all other problems that the country is facing. Therefore, he set up a number of institutions all over the country including IIT's, IIM's and AIIMS for the promotion and development of STI. In the Five Year Plans that Nehru initiated, his scientific temper and vision was reflective in many ways. Nehru gave constant support to scientists to start new institutions in the country. Nehru's support to scientists like Homi Bhabha was crucial in many ways in developing India's first atomic energy programme. M.Visvesvaraya who was a noted civil engineer of that time joined hands with Nehru in building dams in the country. Nehru also sought the help of scientists like S.S Bhatnagar, D.S Kothari, P.C Mahalanobis etc to make India a frontrunner in science and technology.

David Arnold points out that “Nehruvian science was basically state science; that is science conducted for the people but at the direction and discretion of the state” (Arnold, 2013). Nehru's philosophy was that science would help to transform one's beliefs based on facts. It would help one to reinvent himself in a new light of rationality and logic. It was Nehru's unflinching belief in the benefits of science and technology that persuaded him later on to introduce and adopt a Scientific Policy Resolution in the Indian Parliament in 1958. For Nehru, science was a means to enquire the ultimate truth. He believed that science would liberate an individual from the clutches of tradition and superstitions. Nehru wrote once that “the impact of science and modern world have brought a greater appreciation of facts, a more critical faculty, a weighing of evidence, a refusal to accept tradition merely because it is tradition” (Mahanti, 2016).

Gandhi and Nehru had different views on science and technology. While Nehru viewed Science as a panacea for India's problems; Gandhi was warning about the dangers that technology may invite in future. In the modern age, there is a tendency to project Gandhi as someone who stood against science and technology and to dismiss his views as orthodox. Gandhi was never against the use of science in improving human lives. What he advised was that technology and science shall not be allowed to enslave people. He argued that science must not deviate from the path of humanity and non-violence (Guha,2006). Though it was Nehru's views that India adopted in its post independent phase, Gandhian views on science and technology is a reminder in many ways as the world is going through some real challenges at present posed by science and technology especially in relation to environmental security.

■ 2.2 1960's to 1990's: Initiatives of Prime Ministers Indira Gandhi and Rajiv Gandhi

After the demise of Nehru, his efforts to promote science and technology found a new momentum when his daughter Indira Gandhi became the Prime Minister of the nation in 1966. One of the challenges that India faced during Indira Gandhi's regime was that how to make India self-reliant in terms of food security. Food shortage and increasing poverty forced Mrs. Gandhi to strongly push for agricultural revolution. The agricultural revolution or the Green revolution started in India by testing high yielding variety seeds enhanced the country's agricultural production substantially during this period. The success of green revolution and subsequent progress in the agricultural sector gave India a new impetus to take more drastic reforms in various sectors. India made path breaking advancements in biotechnology and nuclear energy during this period. India proved its nuclear weapon capability in 1974 by testing nuclear bombs in Pokhran, a place in the state of Rajasthan in India. However, India received sanctions in return from USA for conducting these nuclear tests. At present, India is a major nuclear power in the world which is having Civil Nuclear Deal with USA.

Space research was another important area of development. During Nehru's time, under the guidance of scientist Vikram Sarabhai, India had given form to the Indian National Committee for Space Research (INCOSPAR).

During Indira Gandhi's period, she also heavily invested in space research and in 1969, INCOSPAR was renamed into ISRO. Scientist Satish Dhawan was appointed as the Chairman of ISRO in 1972 and since then space research went to further heights. In 1975, India launched its first satellite called „Aryabhata“. Indira Gandhi provided a political patronage to India's Science and Technology programme (Oldham, 2008:782). The Department of Science and Technology which acts as the pivot to the promotion of science and technology in India today was set up during the time of Indira Gandhi. She initiated the setting up of Indira Gandhi Centre for Atomic Research in 1971. In 1983, building the first scientific base station in Antarctica named „Dakshin Gangotri“ was another important milestone in Mrs. Gandhi's achievements in the field of science and technology.

Another important sector wherein significant progress was made was the defence sector. The world was witnessing a Cold War between the US and the Soviet Union during this time. It was important for India to achieve self-reliance in the defence sector as it was an important component of India's national security programme. Mrs. Gandhi paid special attention to spend more in the defence sector especially in defence research (ICSA: 1985). She enhanced India's defense and military capabilities subsequently. If India has the ability to launch long range missiles now, credit for that goes to none other than Mrs. Indira Gandhi.

After the assassination of Indira Gandhi in 1984, her son Rajiv Gandhi also carried on the efforts to promote science. Rajiv Gandhi's contributions were primarily in three fields-a) in tele-communications b) Information Technology c) Automobile sector. He is considered as the father of IT & Telecom revolution in India. With the help of his adviser Sam Pitroda, Rajiv Gandhi introduced a new digital culture to India which was not so familiar for the country till that time. It was the revolutionary ideas of Rajiv Gandhi to initiate computerisation and setting up internet networks all over the country that led India to a modern digital age (Chand:1991). Under the initiative of Rajiv Gandhi, in 1984, the Centre for Development of Telematics (C-DOT) was set up to disseminate the telecommunication technology. Rajiv Gandhi reduced import tariffs substantially on computers to enhance its availability in the country. Rajiv Gandhi's period was also a transition period for India as the country was preparing itself to embrace a new era of liberalisation.

■ 2.3 1990's to 2014: Initiatives of Dr. Manmohan Singh

In the 1990s, India was going through an economic crisis. The Gulf War of 1991 had worsened India's economic condition. The Government under the Prime Ministership of Narasimha Rao initiated a series of economic reforms in the country which opened the Indian economy completely integrating itself to the global market. The budget presented by then Finance Minister of the country Dr. Manmohan Singh in 1991-92 introduced a set of reforms for rapid modernisation of the public sector. As the Finance Minister of the country, Manmohan Singh had two challenges in front of him. One was how to bring down the internal debt and the other was how to curtail India's rapidly growing debt crisis. Therefore, he introduced a new industrial policy for the country. India embraced the idea of Foreign Direct Investment (FDI). This made India a market for other countries to invest in their preferred sectors. During this period, India reduced the import licensing drastically and started to promote exporting to other countries. If India had remained as a closed economy till that time, it was the financial reforms initiated by Manmohan Singh that enabled India to open its market for competition with the global players. In a way, this idea to open up the economy and market helped India to gradually recover from the financial crisis it was undergoing at that point of time. This move to liberalise the economy was beneficial for the growth of science and technology as well as it brought back many scientists to India who had earlier migrated to other countries (S.Swaminathan & Aiyar:2016). India started to be acquainted more with an array of new technologies and innovations taking place in the western world. Public-Private Partnership in key areas of research were promoted. India's global standing in science and technology improved substantially during this period. The introduction of LPG model (Liberalisation, Privatisation and Globalisation) was actually a shift from India's so far prevailed science and technology policy framework. If India's focus till that time was more or less on indigenously developed science and technology model, after 1990s for the first time India realized that self-reliance in science and technology could be achieved only through a kind of collaboration with the global public-private players. Today science and technology is a key component of India's economic growth trajectory.

After the fall of Narasimha Rao government in the very next general election, India witnessed a short period of political instability as political parties failed to form a stable government. This instability ended when Atal Bihari Vajpayee government finally sworn in 1998. Prime Minister Vajpayee didn't move away from the financial reforms introduced by the Narasimha Rao government, but carried on with it. Defence and telecom industry were the two sectors wherein Vajpayee government kept its focus. India conducted nuclear tests in Pokhran in Rajasthan once again after the Indira era which made India an indomitable nuclear power in the world. Today, India is one of the few states

in the world which has nuclear power capability.

After the defeat of BJP led Vajpayee Government in the next general election in 2004, Dr. Manmohan Singh took charge as the Prime Minister of the country. This was a golden opportunity for Dr. Manmohan Singh to continue the reforms that he had introduced way back in 1991-92. Science and technology started to be used as a tool for diplomatic engagement with foreign countries during this period. In 2006, the signing of Indo-U.S civilian nuclear deal was a breakthrough for the Manmohan Government. The government took many initiatives to encourage research and innovation all over the country. For university students, different scholarships were announced for undertaking research in key areas of science and technology. India made instrumental progress in research and innovation in the pharmaceutical sector during this time. However, India's progress in the industrial sector was not up to the mark. One of the reasons for this was the issues that India was facing in the global intellectual property rights regime. The period from 2010 to 2020 was declared as the „Decade of Innovation“. The National Innovation Council was set up during this period to devise strategies to promote inclusive innovation in India.

In 2013, Manmohan Singh Government unveiled the new Science, Technology and Innovation Policy realizing that innovation is the key to development. How new knowledge that are being produced through innovation could be translated for commercial purpose was one of the key objectives of this policy. Another objective was how the outcomes of science, technology and innovation could be translated for the benefit of common man and how to make India one among the top five global scientific powers in the world (DST, 2013). However, with the downfall of Manmohan Singh Government in the 2014 general election, this policy also lost momentum.

After Manmohan Singh Government, BJP led Narendra Modi Government assumed power in 2014. Modi Government proposed a number of programmes for attracting investments and promoting entrepreneurship such as Digital India, Make in India, Stand Up India etc. He constituted a 21 member committee called the „Prime Minister's Science, Technology and Innovation Council (PM-STIAC) to assist him in matters related to science and technology. As a follow up to the first unmanned space mission that India had conducted in 2008 called Chandrayan I, in 2019, India launched its second unmanned lunar mission- „Chandrayaan 2. Before that in 2014, India had successfully carried out its Mars Mission named „Mangalyaan“. All these were important milestones in the development of science and technology in the country. However, it is to be admitted that India is still lagging behind countries like China in the field of Science and Technology. In Innovation, India has a long way to travel. India stands at 52nd position in the Global Innovation Index as per the 2019 statistics („India Jumps 5 Places to 52nd“, 2019).

■ 3.0 STI: SCOPE AND EMERGING CHALLENGES

India's track record in science, technology and innovation is commendable in many ways. India has marked a place of its own in pharmaceutical sector, automobiles, nuclear technology and software industry. India's scientific growth has significantly transformed the country's agricultural sector, health sector, education sector, defence sector etc. For India, technology is now a tool for better governance as well. With the dissemination of technology, even common people can make use of the benefits of digital banking transactions and marketing. Even digital profiling is a reality now. Reports say that internet users in India are expected to touch 627 million in 2019 („The Internet Users in India to Reach 627 Million“, 2019).

Government is providing various services to public through digital platforms in these days. Voter ID Cards, Aadhar, Bank Accounts etc have already become digitalized. Government is mulling upon providing online voting facilities for non-resident Indians in upcoming elections. In the higher education sector, now a number of new Courses are being offered by UGC and CSIR through online platforms. Classrooms in India are on the path to become Smart classrooms. In the health sector, Super Specialty hospitals are offering robotic surgeries to patients. In the agricultural sector, India is making use of technology for weather prediction and to develop high yielding variety seeds. In disaster prevention and management, technology has a huge role to play.

India is a country which is enjoying a demographic dividend. In India, working age population is larger than the dependent population. In software industry, top companies in the world recruit young people from India. India is a good market for all big multinational companies in terms of manpower and goods import. India has grown to become a knowledge economy. With globalization and technology diffusion, new changes are happening not only in the Indian market but also in domestic politics. Introduction of Electronic Voting Machines and VVPATs are changing the nature of democracy and governance in the country. Srinivas & Jayan (2018) note that „India is an innovation hub, at least in pharmaceuticals, computer software and automobiles wherein the private sector spends more than half of its

R&D funds. The Public sector is defence oriented.”

It is important for India to develop an ecosystem for innovation. India needs to spend more on Research and Development. As of now, the country’s expenditure on R&D is not adequate. India is spending only less than 1% of its GDP for research and development (“At 0.7% of GDP”, 2019). The various figures of expenditure in R&D published by the National Science and Technology Management Information System (NSTMIS) shows that India’s expenditure in this field is not sufficient. In India, the private sector must be encouraged and strengthened more to undertake research in key areas of national interest like agriculture, health, education sector etc. It is a fact that the complicated IPR and patent regime may be limiting India’s full- fledged growth in the sector of science and technology. As of now, science and technology is largely remaining as a subject of the Centre, and not of the states. If it has to expand further, it is important that the states need to be assigned with a larger role.

While science and technology make the life easier, it has also brought forth several privacy related issues. Ensuring cyber security and implementing cyber laws are important for the country’s growth in the field of technology in the long run. While the government takes efforts to store the data of citizens in digital platforms, it is also equally important for the government to make sure that this data that is being collected is not getting leaked to non-state actors. If it happens, it would be raising larger questions to national security as well. Hence, though e-governance is the norm, one may need to acknowledge the serious challenges that science and technology is posing to individual and state security.

The growth of science and technology in India is interlinked with the domestic politics of the country. Political agenda of various political parties have a decisive say in shaping the future of science in India. Even in deciding the budget allocation for science, politics has a role to play. Science is rational and evidence based. However, irrational comments often made by responsible political leaders and twisting of scientifically proven facts for their petty political gains is becoming a regular feature of Indian politics today. One such comment was that “Charles Darwin’s theory of evolution by natural selection lacked scientific base and should be withdrawn from the school curricula” (Srinivas & Jayan, 2018). Another comment sounded like this “plastic surgery is not a modern invention and it had existed since the ancient period. Lord Ganesha is an example for that” (Srinivas & Jayan, 2018). Thus science is being used as a political weapon as well.

The advancement of science and technology has indeed altered our perception and thinking about „development“. Academicians like Ashis Nandy link science to hegemony and violence (Nandy, 1988). It is true that scientific and technological innovations may sometimes alienate and displace people from their own land. India is pursuing a neo-liberal agenda in terms of science, technology and innovation. This poses larger questions with respect to accessibility, availability and affordability of many of the goods and services that are being produced as a result of scientific inventions. On the one hand, resources are becoming scarce day by day; on the other hand, common people who are the real victims of all these developmental processes are finding it extremely difficult to get access to finished goods. When India marches ahead to become a major global power in science and technology, what is at risk is the environment. For developmental projects, forests and other natural resources are being exploited mindlessly. This is true in the case of almost all countries. This has pushed the world to the verge of global challenges such as climate change. On the one side while science and technology facilitate one’s life in multiple angles, on the other side, misuse of it is exposing one to new challenges. Any kind of development which excludes people and environment is lopsided. Therefore, science and technology must reorient itself to focus more on sustainable development and inclusivity. There is no doubt that Science and technology is transforming the social, political and economic behavior of all. It changes one’s thinking pattern too. Nevertheless, in India, still there is a large section of people who are suspicious of the scientific achievements that India has made so far. The politicization and religionization of science is a reality even today in Indian society and this is forcing science to take a backseat. Article 51 A(h) of the Indian constitution reminds that “it shall be the duty of every citizen of India to develop the scientific temper, humanism and the spirit of inquiry and reform”(The Constitution of India).

■ 4.0 CONCLUSION

When one examines the history of STI journey of India, it is evident that the country has made significant achievements in the field of science and technology over the past 72 years. It was Nehru’s scientific vision that laid the foundation stone for India’s development as a scientific power. Later, Prime Minister Indira Gandhi’s determination to develop India as a nuclear power and Prime Minister Rajiv Gandhi’s various initiatives in STI increased the pace of scientific development of the country. India’s shift from a foreign technology dependent nation

to a manufacturer of indigenous technology was never a smooth process. Economic constraints, complicated domestic politics, religious misconceptions, lack of awareness of people etc have negatively impacted the growth of science in the country. If state was the sole actor that pushed science and technology in the initial years of Indian independence, now with the inauguration of a liberalized era, private sector has also started to play a dominant role in STI while the state is backtracking from it. The public sector investment in research and development is not adequate in the past few years and this is discouraging the private players from investing more in research and innovation. It is important to note here that without the active involvement and investment from the side of both public and private sectors, it would be difficult for India to enter into the next stage of scientific development.

Twisting of scientific facts for serving vested political interests is a strategy that is tactfully used by the conservative rightwing forces in Indian politics. While science thrives on logic, evidence and rationality, politicians make use of science by mixing it up with mythology and folklore to attain their political goals. Any kind of mixing up of these two, that is science and politics, would seriously affect India's prospects to become a scientific super power. Complicated IPR regime, lack of adequate linkage between industry and academia, least attention to retain human resource in the country itself, limited budget for R&D etc are the present-day challenges to India's STI regime.

The success of any STI policy is dependent upon institutional support and people's participation. There is a visible class divide and gender gap when it comes to the question of who all are actually enjoying the benefits of scientific inventions. Most of the time marginalized sections and women are out of the STI paradigm. Therefore, it is one of the objectives of 2013 STI policy that more gender parity needs to bring in STI activities. It is important that the advantages of technology to be available for all in a cost-effective manner. Irrespective of all differences, more inclusivity and accessibility need to be brought in STI. Technology would succeed only when it touches the life of the common people for better. In order to do so, technology needs to be more democratized. Equity, justice and inclusion must be the norm that drives the policy making in the age of technological governance. Science and Technology Studies that are emerging now are oriented towards this direction. People belong to all class despite their colour, gender, status and age must be in a position to enjoy the fruits of science. It is important that science needs to be liberated from the clutches of elitism. It must develop itself as an interdisciplinary area that can have a holistic understanding of the problems around it. Universities as the centers of learning and knowledge dissemination must be encouraged to undertake more rigorous scientific research. People's science movements and civil society activism could be detrimental in democratizing science and giving a fresh perspective to it with regard to the role that it is supposed to take up in the modern era.

ACKNOWLEDGEMENT

I would like to thank the anonymous reviewer for valuable comments and suggestions which has indeed helped in improving this Article. Thanks are due to the University of Kerala for permitting me to present this Paper in the 2nd South East Asian International Conference on Science, Technology and Innovation Policy Management held at the Universiti Teknologi Malaysia, Kuala Lumpur from 7th to 8th November 2019.

REFERENCES

- Arnold, David (2013), "Nehruvian Science and Postcolonial India", *Chicago Journals*, Vol 104
"At 0.7% of GDP, India's R&D Expenditure in Science is less than BRIC Nations", 22 November 2019, *Business Today*, <https://www.businesstoday.in/current/world/india-gdp-randd-expenditure-in-science-is-less-than-bric-nations/story/390874.html>
- Chand, Attar (1991), "*Rajiv Gandhi: His Mind and Ideology*", New Delhi: Gian Publishing House, P.375
- DST (2013), "Science, Technology and Innovation Policy", Department of Science and Technology, Government of India: New Delhi.
- Guha, Ramachandra (2006), "Gandhi and Science", *The Telegraph*, Delhi, 4th February 2006
- ICSA (1985), *Indira Gandhi on Science and Self Reliance*. Indian Science Congress Association, Calcutta
- Mahanti, Subodh (2016), "Nehru's Vision of Scientific Temper", *Journal of Scientific Temper*, Vol 4, No. 3&4
- Narlikar, Jayant (2003), "Astronomy, Pseudoscience and Rational Thinking", *Highlights of Astronomy*, Vol. 13
- Nandy, Ashis (1988) "Introduction: Science as Reason of State" in "*Science, Hegemony and Violence, A Requir for*

- Modernity*”, Delhi:Oxford University Press.
- Nehru (1946), *The Discovery of India*, Delhi: Oxford University Press, P. 409
- Oldham, Geoffrey., (2008), “Mrs. Gandhi’s Approach to Science and Technology”, *Science and Public Policy*, Vol 35, Issue 10, P.782
- Prasad, Shambhu (2001), “Towards an Understanding of Gandhian Views on Science”, *Economic and Political Weekly*, Vol. No: 36, Issue: 39.
- S.Swaminathan and Aiyar, Anklesaria, “Twenty-Five Years of Indian Economic Reform”, CATO Institute, 26 October 2016: Policy Analysis No.803
- Srinivas &Jayan TV (2018), “Where is Indian Science Headed?”*The Hindu Business Line*, 30 January 2018
- Solomon, Saskia (2019), “The False Scientific Claims Made during Modi’s First Term”, *The Caravan*, 26 June 2019
- The Constitution of India*, India, 26 January 1950
- “India Jumps 5 Places to 52nd Rank in Global Innovation Index 2019”, *The Economic Times*, 24 July 2019, <https://economictimes.indiatimes.com/news/economy/indicators/india-jumps-5-places-to-52nd-rank-in-global-innovation-index-2019/articleshow/70362639.cms>
- “Internet Users in India to Reach 627 Million in 2019:Report”, *The Economic Times*, 6 March 2019, <https://economictimes.indiatimes.com/tech/internet/internet-users-in-india-to-reach-627-million-in-2019-report/articleshow/68288868.cms>