The Role of Science and Technology Diplomacy in Indian Foreign Policy
An Assessment of Issues and Opportunities

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The Role of Science and Technology Diplomacy in Indian Foreign Policy: An Assessment of Issues and Opportunities

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Abstract

Science and Technology (S&T) has historically shaped international diplomacy before contemporary times and continues to be influential in foreign policy and International Relations (IR) during the present era. Civilizations, empires and modern nation-states have consistently sought to utilize S&T to navigate through key periods of human history such as European Colonialism, the two World Wars, the Cold War and the ongoing COVID-19 pandemic.

In recent times — the role of S&T in shaping diplomacy, foreign policy and IR has gained an increasing amount of international academic attention with organizations such as the Royal Society; American Association for the Advancement of Science (AAAS); and Research and Information System for Developing Countries (RIS) striving to situate the theoretical basis of the field for scholarly and practical application, including at a state level in the contemporary international system. Like the US and Japan, India — a state with a vast S&T infrastructure — has also declared its intention to utilize S&T Diplomacy to achieve its foreign policy objectives through its Science, Technology and Innovation Policy 2013, and through other significant instruments of state policy.

However — unlike the US and Japan — the South Asian rising power's utilization of S&T Diplomacy as an instrument of foreign policy meant to achieve state interests remains under-studied and poorly understood. It is in this context that this study seeks to situate the role of S&T Diplomacy in India's foreign policy by examining the S&T components of its development cooperation and space programmes, and their impact on the country's international relations in the 21st Century. This study draws from a rich reservoir of primary documents and a set of original interviews. It also builds upon secondary literature for theoretical and substantive components. Through this study, an attempt is made to

contribute to the existing understanding of the nature of India's S&T Diplomacy to aid future research efforts on the subject.

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List of Abbreviations

4G: Fourth Generation

AAAS: American Association for the Advancement of Science

AAGC: Asia Africa Growth Corridor

AAP: Aam Aadmi Party

ABM: Anti-Ballistic Missile

ACIAR: The Centre for International Agricultural Research

ADB: Asian Development Bank

ADCOS: Advisory Committee for Space Sciences

ADNOC: Abu Dhabi National Oil Company

AI: Artificial Intelligence

AIDS: Acquired Immunodeficiency Syndrome

AISRF: Australia-India Strategic Research Fund

APRSAF: Asia-Pacific Regional Space Agency Forum

AQ: Abdul Qadeer (Khan)

ASAT: Anti-Satellite

ASEAN: Association of Southeast Asian Nations

BARC: Bhabha Atomic Research Centre

BEL: Bharat Electronics Limited

BHEL: Bharat Electronics Limited

BIMSTEC: Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation

BJP: Bharatiya Janata Party

BRICS: Brazil, Russia, India, China, and South Africa

CBD: Convention on Biological Diversity

CBM: Compressed Baryonic Matter

CDRI: Coalition for Disaster Resilient Infrastructure

CIS: Commonwealth of Independent States

CNES: The National Centre for Space Studies (France)

CNSC: Canadian Nuclear Safety Commission

CoEs: Centres of Excellence

COMCASA: Communications Compatibility and Security Agreement

COPUOS: UN Committee on the Peaceful Uses of Outer Space

COVAX: COVID-19 Vaccines Global Access

COVID-19: Coronavirus Pandemic 2019

CSR: Case Study Research

DAE: Department of Atomic Energy

DBT: Department of Biotechnology

DDA: Delhi Development Authority

DECU: Development and Educational Communication Unit

DESY: Deutsches Elektronen-Synchrotron

DFG: DST-German Research Foundation

DFID: Department for International Development

DFQF: Duty Free Quota Free

DIA: Defence Intelligence Agency

DIPAC: Defence Imagery Processing and Analysis Center

DORIS: Doppler Orbitography and Radio-positioning Integrated by Satellite

DoS: Department of Space

DPA: Development Partnership Administration

DPPG: Defence Procurement and Production Group

Dr.: Doctor

DRDL: Defence Research and Development Laboratory

DRDO: Defence Research and Development Organisation

DRR: Disaster Risk Reduction

DSA: Defence Space Agency

DSRO: Defence Space Research Organization

DST: Department of Science and Technology

DTTI: Defence Trade and Technology Initiative

EAM: External Affairs Minister

EAS: East Asia Summit

ECHO: European Civil Protection and Humanitarian Aid Operations

EIB: European Investment Bank

ESA: European Space Agency

EU: European Union

EUMETSAT: European Organization for the Exploitation of Meteorological Satellites

EXIM: Export-Import

FAIR: International Facility for Antiproton and Ion Research

FAO: Food and Agriculture Organization

FDI: Foreign Direct Investment

FISD: Forum for Indian Science Diplomacy

FY: Fiscal Year

G-7: Group of Seven

G77: Group of Seventy-Seven

GBP: Pound Sterling

GDP: Gross Domestic Product

GEF: Global Environment Facility

GERD: Gross Domestic Expenditure on Research and Development

GFATM: Global Fund to Fight AIDS, Tuberculosis and Malaria

GoI: Government of India

GPM: Global Precipitation Measurements

GRP: The Global Research Partnership on Food and Nutrition Security, Health and Women

GSLV: Geosynchronous Satellite Launch Vehicle

GTC: Grain Trade Convention

HADR: Humanitarian Assistance and Disaster Relief

HAL: Hindustan Aeronautics Limited

HCQ: Hydroxychloroquine

HIPCs: Heavily Indebted Poor Countries

HSFC: Human Space Flight Centre

IADC: Inter-Agency Space Debris Coordination Committee

IAEA: International Atomic Energy Agency

IAM: Indian Aid Mission

IBRD: International Bank for Reconstruction and Development

IC-IMPACTS: India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation and Sustainability

ICBM: Inter-Continental Ballistic Missile

ICC INSAT: Coordination Committee

ICIMOD: International Centre for Integrated Mountain Development

ICM: Indian Cooperation Mission

ICMR: Indian Council for Medical Research

ICOC: International Code of Conduct

ICT: Information and Communications Technology

IDA: International Development Association

IDCR: Indian Development Cooperation Research

IDEAS: Indian Development and Economic Assistance Scheme

IDI: India Development Initiative

IES: India Economic Strategy

IFCPAR/CEFIPRA: Indo-French Centre for the Promotion of Advanced Research

IG-SCID: Indo-German Science Centre for Infectious Diseases

IGA: International Grains Agreement

IGC: International Grains Council

IGCS: Indo-German Center for Sustainability

IGICH: Indira Gandhi Institute for Child Health

IGMDP: Integrated Guided Missile Development Programme

IGSTC: Indo-German Science and Technology Center

IIDCA: India International Development Cooperation Agency

IIoE: International Indian Ocean Expedition

IIRS: Indian Institute of Remote Sensing

IIST: Indian Institute of Space Science and Technology

IISU: ISRO Inertial Systems Unit

IITs: Indian Institutes of Technology

IMPECS: Indo-German Max Planck Centre on Computer Sciences

IMPRINT: Impacting Research Innovation and Technology

INC: Indian National Congress

INCOIS: Indian National Centre for Ocean Information Sciences

INCOSPAR: Indian National Committee for Space Research

INR: Indian Rupee

INSAT: Indian National Satellite

INSPIRE: Innovation in Science Pursuit for the Inspired Research

INVENT: The Innovative Ventures and Technology for Development

IOR: Indian Ocean Region

IORA: Indian Ocean Rim Association

IPCC: Intergovernmental Panel on Climate Change

IPR: Intellectual Property Rights

IPRC: ISRO Propulsion Complex

IR: International Relations

IRBM: Intermediate Range Ballistic Missile

IRNSS: Indian Regional Navigation Satellite System

IRS: Indian Remote Sensing

ISA: International Solar Alliance

ISPRL: Indian Strategic Petroleum Reserves

ISRO: Indian Space Research Organisation

ISTRAC: ISRO Telemetry, Tracking and Command Network

IT: Information Technology

JCC: Joint Cooperation Committee

JTG: Joint Technical Group

JWG: Joint Working Group

KKP: The Global Knowledge Partnership Programme

LEO: Low Earth Orbit

LEOS: Laboratory for Electro-Optics Systems

LoCs: Lines of Credit

LPSC: Liquid Propulsion Systems Centre

LTP: Long-Term Program

MADRAS: Microwave Analysis and Detection of Rain and Atmospheric Structures

MCF: Master Control Facility

MDA: Maritime Domain Awareness

MDGs: Millennium Development Goals

MERS: Middle East Respiratory Syndrome

MIT: Massachusetts Institute of Technology

MoEFCC: Ministry of Environment, Forest and Climate Change

MoES: Ministry of Earth Sciences

MoM: Mars Orbiter Mission

MOST: Ministry of Science and Technology

MoU: Memorandum of Understanding

MPG: DST-Max Planck Society

MPhil: Master of Philosophy

MTCR: Missile Technology Control Regime

NAM: Non-Aligned Movement

NARL: National Atmospheric Research Laboratory

NASA: National Aeronautics and Space Administration

NE-SAC: North Eastern-Space Applications Centre

NIAS: National Institute of Advanced Studies

NIDC: National Industrial Development Cooperation

NISAR: NASA-ISRO Synthetic Aperture Radar

NPT: Nuclear Non-Proliferation Treaty

NRSC: National Remote Sensing Centre

NSA: National Security Adviser

NSERC: Natural Sciences and Engineering Research Council, Canada

NSG: Nuclear Suppliers Group

NSIL: NewSpace India Limited

NSSP: Next Steps in Strategic Partnership

OBOR: One Belt One Road

ODA: Official Development Assistance

OECD: Organisation for Economic Co-operation and Development

OST: Outer Space Treaty

PAROS: Prevention of an Arms Race in Outer Space

PC-NNRMS: Planning Committee on National Natural Resources Management System

PhD: Doctor of Philosophy

PLI: Production Linked Incentive

PM: Prime Minister

PMO: Prime Minister's Office

PMRF: Prime Minister Research Fellows

PP.: Pages

PPE: Personal Protective Equipment

PPP: Purchasing Power Parity

PRC: People's Republic of China

PRL: Physical Research Laboratory

PSLV: Polar Satellite Launch Vehicle

PSUs: Public Sector Undertakings

R&D: Research and Development

RI STC: Russian-Indian Scientific and Technological Center

RIMES: Regional Integrated Multi-Hazard Early Warning System for Africa and Asia

RIS: Research and Information System for Developing Countries

RoK: Republic of Korea

RRPCL: Ratnagiri Refinery and Petrochemicals Limited

S&T: Science and Technology

S&T Diplomacy: Science and Technology Diplomacy

SAARC: South Asian Association for Regional Cooperation

SAC: Space Applications Centre

SAPHIR: Sounder for Probing Vertical Profiles of Humidity

SARI/EI: South Asia Regional Initiative for Energy Integration

SARAL: Satellite with ARgos and ALtiKa

SARS: Severe Acute Respiratory Syndrome

SAS: South Asia Satellite

SAU: South Asian University

SCAAP: Special Commonwealth Assistance for Africa Programme

SCL: Semi-Conductor Laboratory

SDGs: Sustainable Development Goals

SDPs: Small Development Projects

SDSC: Satish Dhawan Space Centre

SHNP: The Strategic Health and Nutrition Partnership

SICI: Shastri Indo-Canadian Institute

SITE: Satellite Instructional Television Experiment

SLV: Satellite Launch Vehicle

SME: Small and Medium-Sized Enterprises

SSA: Space Situational Awareness

STEM: Science, Technology, Engineering and Mathematics

STI: Science, Technology and Innovation

STI 2013: Science, Technology and Innovation Policy 2013

STI Diplomacy: Science, Technology and Innovation Diplomacy

STP 2003: Science and Technology Policy 2003

STSG: Senior Technology Security Group

TB: Tuberculosis

TCIL: Telecommunications Consultants India Limited

TERI: The Energy and Resources Institute

TES: Technology Experiment Satellite

UAE: United Arab Emirates

UK: United Kingdom

UNCCD: United Nations Convention to Combat Desertification

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

UNESCAP: United Nations Economic and Social Commission for Asia and the Pacific

UNESCO: United Nations Educational, Scientific and Cultural Organization

UNFCCC: United Nations Framework Convention on Climate Change

UNGA: United Nations General Assembly

UNO: United Nations Organization

UNOOSA: United Nations Office of Outer Space Affairs

UNSC: United Nations Security Council

UP: Uttar Pradesh

UPA: United Progressive Alliance

URSC: UR Rao Satellite Centre

US: United States

USAID: United States Agency for International Development

USD: United States Dollar

USG: United States Government

USGPO: United States Government Publishing Office

VECC: Variable Energy Cyclotron Centre

VSSC: Vikram Sarabhai Space Centre

WCSC: World Class Skill Centre

WFP: World Food Programme

WFS: World Food Summit

WHO: World Health Organization

WIPO: World Intellectual Property Organization

Acknowledgements

Writing this part of the research is — admittedly — the hardest part of writing this PhD thesis since it involves answering the fundamental question that is: *How can one human being possibly acknowledge the abundant kindness of so many others in a journey of learning fraught with uncertainties such as this without leaving instances that should definitely merit a mention?* I do not have the answer. But I can try and attempt to pen some of my thoughts.

Given an academic background in both Science and Technology and International Relations,[1] I sought to pursue further research in Science and Technology Diplomacy in the context of my home country India. My PhD proposal — once made after many futile attempts — was then sent out to several experts in the field whom I hoped would respond to it. The proposal met with some responses, and one such response came from Dr. Harsh V. Pant, Professor of International Relations at King's College London — who would later go on to become my primary supervisor for this research. An instance in this regard bears mentioning. Whilst seeking guidance on the PhD application process, a consultant in a prominent global education consultancy in Nehru Place, New Delhi looked disparagingly at the humble author of this thesis — when he asked for advice on how to apply to King's College London — and quite simply remarked: 'Why don't you try for other universities?' The reply from Professor Pant was thus both unexpected and also rather unnerving.

Professor Pant not only responded but also put the author of this thesis in touch with Dr. Jahanvi Phalkey — whom I had also never met previously but knew through her many eminent academic contributions made to the history of Indian Science and Technology. And thus began my academic interaction with one of the masters of the field of Contemporary India Research. Dr. Phalkey asked for sources on the subject and further asked if a full-fledged research on the subject — fascinating as it was in notion — was actually feasible in

[1] The author of this research holds a Bachelor of Engineering (Electronics and Communication, Honors) degree from Dr. Bhimrao Ambedkar University, Agra, India — formerly known as Agra University — since 2008. He also earned a Master of Arts (International Relations, Merit) from Middlesex University, London in 2015. A Master of Business Administration (MBA) degree, earned from the University of Wales Institute, Cardiff in 2011 — now known as Cardiff Metropolitan University —also merits attention in this footnote in the interest of full disclosure.

practice. Dr. Phalkey then guided this author to build a database of primary sources on India's external engagement in the field of Science and Technology Diplomacy — a concept that is poorly understood till this date — to fuel this research.

Once the research proposal was fortified and accepted, I reported to my university in London to pursue my study in October 2017. I then benefitted from the academic guidance from the likes of Dr. Kriti Kapila, Dr. Louise Tillin and Dr. Thorsten Wojczewski — and several other experts. However, I was still not sure on how to connect the sources that I had gathered with the actual contours of India's foreign policy. I recall describing this to Professor Pant in a haphazard manner characteristic of a stereotypical confused PhD entrant in November 2017 — only to get an encouraging reply that set the research on the right course. Also, Dr. Sunil Mitra Kumar was the rock to whom I turned to whenever I faced any bureaucratic issues, and his advice and directions were always most timely, kind and valuable — aiding my progress through the PhD program.

Throughout my research, both supervisors continuously sent valuable research material to aid the effort. I was also provided with contact details in case of emergencies by both my supervisors — and I recall, in one case, calling Professor Pant to seek urgent supervisory advice only to receive it and to later know that my kind principal supervisor was actually in a hospital at the time in September 2019 but still attended to research queries made by his students despite his health issues. Conventional wisdom has it that supervisors are the key to a successful thesis. I do not know whether my humble scholarly efforts will ultimately succeed. All I know is that I have worked hard but all faults are mine. All credit — to even the slightest instances of rationale in the text that will follow — belong to my eminent, kind and humane academic supervisors.

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I realize that this section should ideally be brief and that I must thus conclude without consuming too much of the reader's time or attention. My final debt of gratitude will be to those who are about to read my research, and have come thus far to view the words of a most humble researcher. Please know that whatever your decision is on the merits of the text and the analysis at hand — you have my most sincere gratitude for taking the time to read what has been written and for having considered the text for its own value.

Chapter 1: Introduction

The introductory chapter of this thesis focuses on the core basics of the research — such as the nature of the research question and the underlying hypotheses, and also the aims and objectives of the research itself. The chapter further seeks to orient its readers towards the significance, timing and originality aspects of the research — to then outline the methodology of the research with an acknowledgement of its inherent limitations.

Research Question and Hypotheses

The text of the research question for this research project in International Relations — titled 'The Role of Science and Technology Diplomacy in Indian Foreign Policy: An Assessment of Issues and Opportunities' — is:

How does India's Science and Technology Diplomacy enable the country to achieve its foreign policy objectives as a rising power in the 21st Century?

The first hypothesis encased in the research question is that *Science and Technology Diplomacy is meant to achieve state interests* — and in the context of this study, foreign policy objectives. In a broader context, the larger justification for this assumption has its origins in times much before the present century. Both Copeland (2016: 631) and Turekian (2018: 5) note that Science & Technology (S&T) has played a vital part in international diplomacy of political entities around the world since before contemporary times. Copeland (2016: 631) — in particular — notes the pivotal role of S&T in giving rise to key events of international significance such as European colonization, the two World Wars and the Cold War. Copeland (2016: 630) also asserts that the defining feature of Science Diplomacy — one that differentiates it from generic international cooperation in the field of S&T — is the primacy of state interests in the decision making and implementation process. Gluckman et al. (2017) also link Science Diplomacy with a state's national interest while Siddhartha (2017: 481) additionally calls for a 'morphological distinction' to be made between generic international S&T cooperation and S&T Diplomacy since the latter has broader implications driven by a state's foreign policy.

A second hypothesis encased in the research question is that *India, as a state, is aware of Science and Technology Diplomacy and utilizes it to achieve its foreign policy objectives in the*

21st Century. Akin to the first hypothesis — the origins on this hypothesis also precede this century. India's first Prime Minister Jawaharlal Nehru (1959: 2-3), in his address to the 46th annual meeting of the Indian Science Congress, confirmed that India sought access to science to address its national interests and also sought to engage with other states in the international system for enabling its rise — but would also refrain from either inter-state competition or rivalry. In the 21st Century, India — through its *Science and Technology Policy 2003* (STP 2003) — viewed international S&T cooperation as a tool to 'further national interests as an important component of foreign policy initiatives' with an emphasis on South-South Cooperation, and a focus on South Asia (Ministry of Science and Technology, Government of India 2003: 111). In order to meet India's national needs in the 21st Century, the STP 2003 also sought to 'promote international science and technology cooperation towards achieving the goals of national development and security, and make it a key element of our international relations' (Ministry of Science and Technology, Government of India 2003: 101-103).

21st Century India's intention to utilize S&T Diplomacy to further its national interests and foreign policy objectives is further made clear by its *Science, Technology and Innovation Policy 2013* (STI 2013) — the most influential policy guiding the country's S&T activities in contemporary times — which clearly states that the 'policy framework will enable strategic partnerships and alliances with other nations through both bilateral and multilateral cooperation in science, technology and innovation. Science diplomacy, technology synergy and technology acquisition models will be judiciously deployed based on strategic relationships' (Ministry of Science and Technology, Government of India 2013). In 2015, the country's incumbent Prime Minister Narendra Modi declared that he had put S&T at the forefront of India's diplomatic engagement and India's incumbent President Ram Nath Kovind further stated that New Delhi had put S&T at the center of its pivotal development cooperation strategy in 2018 (Modi 2015; Kovind 2018).

The third key hypothesis in the research question situates India as *a rising power in the 21st Century*. In this regard, Basrur (2014: 177-181) charts the origins of India's economic rise to its 1991 economic reforms but also points towards its 1998 nuclear tests and a subsequent change of grand strategy in the US — which saw Washington, DC and its allies seeking greater

value in a deeper strategic partnership with a resurgent India to balance China's rise in the international system. Basrur (2014: 179-181) also points out that India — in the 21st Century — is a more confident power, which is also willing to integrate itself into the international system to a greater degree than in comparison to the previous century.

The origin point of the study could have alternatively been placed to 1999, which is when Balakrishnan (2017: 292-294) places the establishment of the Office of the Principal Scientific Adviser to the Government of India — and the Division for Investment and Technology Promotion, hosted by the country's MEA. However, new departments in any country realistically take time to become effective and thus the current time frame was found to be more functional. Furthermore, the *United States - India Joint Statement on Next Steps in Strategic Partnership* — which saw a removal of the Indian Space Research Organisation (ISRO) from the US Department of Commerce Entity List came as late as September 2004 — and the Indo-US nuclear agreement secured a US Congressional stamp of approval only in October 2008, placing reliefs on limitations related to New Delhi's crucial space and nuclear promammes in the 21st Century that were non-existent in the previous era (Ereli 2004; Saran 2017: 192-198; Bajoria and Pan 2010).[2]

This bearing of India's rise in the 21st Century international system is also clear in state policy. The STI 2013 shows a remarkable awareness of India's aspirational ambitions from a rising to a global power in the international S&T scenario. The STI 2013 policy in its key elements seeks: 'Establishing world class infrastructure for R&D for gaining global leadership in some select frontier areas of science' and 'Positioning India among the top five global scientific powers by 2020' (Ministry of Science and Technology, Government of India 2013).

The Ministry of Science and Technology, Government of India (2020: 47-51) — in its Draft Science, Technology, and Innovation Policy — favors a proactive STI Diplomacy strategy to further India's national interests in the international system. The policy seeks to address

[2] Prior to its rise in the international system, a marginalized New Delhi had only two strategic partners from the Global North by the end of the 20th Century — in effect Moscow since 1971 and Paris since 1998. The emergence of multiple strategic partners which are clearly aligned to Indian ambitions in the international system as evidenced in the chapters that follow is a more recent 21st Century phenomenon.

critical areas such as the Post-COVID-19 world order; Role of S&T in situating foreign policy priorities; Gaining strategic access to global S&T; and Revisiting the rationale of placing a limited number of mildly-empowered S&T Counsellors abroad to serve the country's interests. Aspects such as shaping the international system through STI and engaging with the Indian diaspora also figure prominently in the draft policy. This *rise in ambition* is itself a marked departure from the more insular state policies of the previous century.

More recently, New Delhi has become a part of several key global multilateral export control mechanisms — such as the Wassenaar Arrangement, the Australia Group, and the Missile Technology Control Regime in the 21st Century. This is in addition of India entering the European Organization for Nuclear Research (CERN) as an Associate Member in 2016 or as a member of the International Thermonuclear Experimental Reactor (ITER) project in France earlier in the 21st Century. India's entry to the Nuclear Suppliers Group (NSG) is still pending given objections from Asian rival China but it has still managed to secure an NSG export regulation waiver since 2008 to grant a semblance of normal nuclear commerce in the international system (Siddhartha 2017: 481-482; Sanders-Zakre 2018: 37; The Wire 2018).

There is further confirmation of the bearing of India's rise in the international system on its foreign policy from incumbent functionaries of the state. India's incumbent External Affairs Minister (EAM) S. Jaishankar (2019) confirms that the country's foreign policy has been dynamic and one that has responded to both internal changes and variations in the external environment since its inception in service of the Indian state by 1947. In fact, Jaishankar (2019) stated that the country had gone through four distinct phases of foreign policy strategy as assessed given the benefit of hindsight before the 21st Century, and even the country's foreign policy in this century had the markings of a dynamic and nimble response to both internal and external variables. Since the advent of the 21st Century, the incumbent EAM situates India as being a 'balancing power' that worked with China on issues of mutual interest such as climate change but also worked towards securing an Indo-US nuclear deal for entering mainstream nuclear commerce in the international system. Given China's aggressive rise — and the emergence of multiple powers with their own unique ambitions in the international system, New Delhi since 2014 also sought to address the emerging multi-

polar system by seeking to work with its multiple strategic partners on issues on common interest.

India sought to emerge as an overall donor of development cooperation in the international system and as a state averse to accepting any 'tied aid' aid from its external partners for meeting national needs by 2003 (Singh 2003: 11-12; 21-22; Saxena 2016: 2-3). Shringla (2020a; 2020b) further confirms that a Rising India in the 21st Century was not only willing to address its own internal challenges but was also found able to answer to a shock as immense to the international system as the outbreak of the ongoing COVID-19 pandemic by coming to the aid of its strategic partners according to New Delhi's own foreign policy calculations. Thus the nature of India as a *rising power* that does not adhere to the dichotomies or the binaries of the usual Global South and North calculations is noteworthy despite some rhetorical anecdotes emerging from the global commentariat pointing otherwise. A functional acknowledgement of this condition contributes to the *originality* of this study.

Another defining feature of the research question is that it utilizes the terminology 'Science and Technology Diplomacy' instead of either 'Science Diplomacy' or 'Technology Diplomacy'. This is a deliberate choice of words since — unlike the *Scientific Policy Resolution* of 1958 and the *Technology Policy Statement* of 1983, which guided the country's science and technology activities through the 20th Century — the country's more recent STP 2003 and STI 2013 policies, which guided the country in terms of S&T in the contemporary century, place emphasis on *both* science and technology.[3] Furthermore, the time period chosen for situating India's S&T Diplomacy is the 21st Century since not only does credible academic theory to address the subject arises fully during this period but the country's policies also begin to show an unmistakable intention for utilizing international S&T cooperation for securing key foreign policy objectives such as national security and development.

[3] This thesis could have alternatively utilized the terminology 'STI Diplomacy' as espoused by the Ministry of Science and Technology, Government of India (2020) in its *Draft Science, Technology, and Innovation Policy*. However, that terminology is only of recent usage in mainstream Indian S&T policy, emerging too close to the final leg of the drafting of this thesis.

Based on the above-mentioned assumptions and hypotheses — the aims and objectives of the research are to identify the *issues* that limit progress of India's S&T Diplomacy in achieving foreign policy objectives in the 21st Century; to identify the *opportunities* that enable progress of the country's S&T Diplomacy in achieving foreign policy objectives in the 21st Century; and to then arrive at *recommendations* for optimal conditions for the role of S&T Diplomacy in Rising India's foreign policy in the 21st Century followed by a duly studied conclusion on the nature of the role of S&T Diplomacy in Indian foreign policy in the 21st century based on the findings of this research.

Significance, Timing and Originality of the Research

As outlined in the section above, the practical relationship between science, technology and diplomacy — despite the sparse academic attention to it being only of recent origin — has constantly shaped international history. However, scholars and practitioners of both S&T and IR have traditionally devoted a very limited amount of attention to situating and understanding this vital relationship, and this trend worryingly endures even in the 21st Century leading to a lack of a coordinated global response to such areas of critical international importance such as health and climate change (Copeland 2016: 628-633; Turekian 2018: 5).

None of these assertions are meant to suggest that the relationship between science, technology and diplomacy — phrased as *Science Diplomacy* or more aptly *Science and Technology Diplomacy* — has *universally* escaped the attention of either academicians or decision makers in governments. Since the rise of the post-World War international system, states such as the United States (US) have consciously taken to S&T to address foreign policy objectives. Landmark scholarly advances relating S&T to foreign policy objectives were made in the US as early 1967, when the Massachusetts Institute of Technology (MIT) Press published *Science, Technology, and American Foreign Policy* authored by Eugene B. Skolnikoff. The United States Government Publishing Office (USGPO) has itself published

the *Science, Technology, and American Diplomacy* series of reports since 1970 to outline new developments in official US S&T Diplomacy.[4]

In the 21st Century, Asian states such as Japan have also been actively pursuing S&T Diplomacy for achieving foreign policy objectives. The *Diplomatic Bluebook 2017: Japanese Diplomacy and International Situation in 2016* — published by Ministry of Foreign Affairs, Government of Japan (2017: 261) — notes that 'Japan, through cooperation in science and technology, has been contributing to the development of science and technology at home and abroad, the promotion of relations with other countries, the peace and stability of the international community, and the resolution of global challenges.' The report further notes that 'Japan is also placing emphasis on effective promotion of "science and technology diplomacy" through the activities of the Science and Technology Advisor to the Minister for Foreign Affairs' (p. 261). Yakushiji (2009: 1-6) links Tokyo's S&T Diplomacy with increasing Japanese soft power and further visualizes it as an element that can contribute to the consolidation of Japan's position as a great power. Thus, there is compelling existing evidence of states employing S&T Diplomacy in their national efforts to achieve larger foreign policy objectives.

However, the sparse academic attention to S&T Diplomacy has also been disproportionately apportioned to established knowledge economies such as the US and Japan, leaving a gap open for scholars to situate the role of S&T Diplomacy in the foreign policies of rising powers. One such rising power is the Republic of India — which may have pursued its own distinct path of S&T Diplomacy since its independence from the British Empire in 1947 — but came to align its S&T Diplomacy with its foreign policy objectives most clearly in the 21st Century through its *Science and Technology Policy 2003* and *Science, Technology and Innovation Policy 2013* (Ministry of Science and Technology, Government of India 2003: 101-103, 111; Ministry of Science and Technology, Government of India 2013).

[4] The recognition of S&T Diplomacy as an instrument to further state interests has also emerged in the foreign policy calculations of great powers such as the UK. The Government of the United Kingdom (2021) — in its *Global Britain in a Competitive Age: The Integrated Review of Security, Defence, Development and Foreign Policy* — seeks to deploy S&T Diplomacy for: 'strengthening our relationships worldwide and supporting the UK's strategic advantage through S&T, building on our Science and Innovation Network in more than 40 countries and our Research and Innovation Hubs in Africa, the Middle East and India' (p. 45).

Outside of critical policy framework, recent invocations by India's incumbent top leadership are also suggestive of New Delhi's intention to pursue S&T Diplomacy in its national interest. As mentioned in the section above, both the incumbent Prime Minister and the President of India have stated on the record their intention of employing S&T in service of the country's foreign policy objectives. Beyond invocation in policy text and speech, there has further been a very conscious movement at the state level in terms of learning, adaptation and assimilation of the core theoretical concepts of S&T Diplomacy in Indian Foreign Policy since at least 2011 that merits scholarly attention.[5] Thus the timing aspect of this study can be established as feasible and propitious.

This study does not seek to conflate the *sparsity* of attention to the role of S&T Diplomacy in Indian foreign policy with the *absence* of scholarly attention to the subject area. Quite the contrary, it acknowledges previous attempts to situate the role of S&T in Indian diplomacy and foreign policy made through the country's history — culminating significantly first in the book *Science, Technology and India's Foreign Policy* authored by Dr. Sunil Sondhi in 1994. In fact, even after Sondhi (1994) — who published his now-dated work shortly after India's 1991 economic reforms — there have been numerous, more recent academic attempts to meaningfully situate the role of S&T Diplomacy in Indian foreign policy.

Major scholarly works addressing India's S&T Diplomacy in terms of volume and significance in the 21st Century most prominently include *Role of Technology in International Affairs* authored by Mallik (2016); *Science Diplomacy: India and the World, Global Science Cooperation Opportunities* authored by Sikka (2017); and *Technology and International Relations: Challenges for the 21st Century* authored by Balakrishnan (2017). However, these pivotal works still leave a window of opportunity for another significant original research to be conducted on the subject of India's S&T Diplomacy due to their nature, scope and ambition.

Mallik (2016) — in his book provides limited but focused attention to defence technology, outer space, cyber space and climate change while carefully placing India's perspectives, challenges and concerns in the process. Till the date of writing of this study, Mallik (2016)

[5] See Prasad (2011: 11-19) and Lempinen (2014).

may have published the most comprehensive and meaningful recommendations for addressing the challenges facing India in terms of S&T Diplomacy.[6] Balakrishnan (2017) also contributes immensely to the understanding of the interplay between technology and International Relations (IR) in the 21st Century but this scholarly contribution is more global in its scope — instead of focusing on India, which the author credibly achieved earlier in his now-dated paper *Role of Technology in India's Foreign Relations*, published in the prestigious Indian Foreign Affairs Journal in 2011.[7] Balakrishnan (2017) attempts to situate the role of technology in IR by addressing a dozen subject areas — encompassing nuclear technology, chemical technology, biotechnology, Information and Communications Technology (ICT), aerospace technology, ocean space, nanotechnology, climate change and energy, health, Intellectual Property Rights (IPRs), and proliferation of weapons — very ably managing to provide his reader with a brief snapshot of each but not necessarily with a detailed reading of the Indian context in his analysis given the global scope of the scholarly effort.

Sikka (2017) devotes a 196 out of a total of 437 pages in his book to transcribing existing primary sources, adding value in terms of diversity of sources. Elsewhere, Sikka (2017) ably covers such critical areas as climate change, nuclear energy, Foreign Direct Investment (FDI) and IPRs while also apportioning some space to India's national S&T policy and the theory of Science Diplomacy. However, both Mallik (2016: 7) and Sikka (2017: 62) acknowledge the three dimensions of Science Diplomacy as first articulated by The Royal Society and AAAS (2010) but do not pursue it or its alternatives any further in their theoretical approach. The overall perusal of existing theoretical frameworks pertaining to S&T Diplomacy — either recent or classical — also remains quite modest in Balakrishnan (2017), Mallik (2016) and Sikka (2017: 62).

[6] As early as 2016, Mallik (248-254) proposed that India's foreign policy personnel should familiarize themselves with the role of technology in IR and its S&T personnel should also familiarize themselves with IR, particularly Indian foreign policy. In the Indian context, Mallik called for a greater harmony between the elements of S&T, foreign policy and international relations in terms of expertise, strategy and policymaking to meet national objectives along with international commitments in a changing external environment. Mallik ultimately called for an Indian Grand National Strategy which combines these elements for India to better position itself as a rising power bound convincingly for a great power status.

[7] See: Balakrishnan, B. (2011). "Role of Technology in India's Foreign Relations". In*: Indian Foreign Affairs Journal* 6 (1): 70-86.

Outside of these major studies, several other sources also contribute to the study of S&T Diplomacy in Indian foreign policy. The paper *Science and Technology Perspectives for India's Foreign Policy*, authored by Relia, Mitra and Ramasami (2014) — published in the Indian Foreign Affairs Journal — and the chapter *Indian Scientists in Defence and Foreign Policy* — authored by Prabhu (2015) and published in the influential 2015 edition of the Oxford Handbook on Indian Foreign Policy — are representative examples in the context. As are other contributions made by scholars such as Siddhartha (2017), Goel (2018), and Sharma and Varshney (2019).

Furthermore, the Observer Research Foundation — a prominent IR think-tank in the country — hosts initiatives such as Nuclear and Space Studies; Development Partnerships; Cybersecurity and Internet Governance; Energy and Resources; Water; and Climate Change and Sustainable Development.[8] The New Delhi-based Centre for Policy Research further supports the *Indian Development Cooperation Research (IDCR)* project to publicly track India's international development cooperation engagement.[9] The concept has also received academic attention at some of the country's most premier educational organizations, such as the Indian Institute of Science — which maintains its own project on Science Diplomacy through its Centre for Policy Research in conjunction with its Department of Science and Technology (Department of Science and Technology, Centre for Policy Research, Indian Institute of Science 2020).

Science Diplomacy courses and research have also recently emerged strongly in state-sponsored think-tanks such as Research and Information System for Developing Countries (RIS) — which hosts its own *Forum for Indian Science Diplomacy (FISD)* since 7 May 2018.[10] RIS has further published academic journals such as *Development Cooperation Review* since

[8] Refer to Observer Research Foundation (2020)'s initiatives on *Nuclear and Space Studies*. Link: https://bit.ly/2UivkwV ; *Development Partnerships*. Link: https://bit.ly/3gZc7Kh ; *Cybersecurity and Internet Governance*. Link: https://bit.ly/2XE6RUN ; *Energy and Resources*. Link: https://bit.ly/2XBf38s ; *Water*. Link: https://bit.ly/2z6Cmxk ; and *Climate Change and Sustainable Development*. Link: https://bit.ly/2AGBi3V for greater detail. Last Accessed on 9 March 2021.

[9] Centre for Policy Research (2020). *Indian Development Cooperation Research.* Link: https://bit.ly/3f8zTCb . Last Accessed on 9 March 2021.

[10] Refer to Forum for Indian Science Diplomacy (2019) for details.

April 2018 and *Science Diplomacy Review* since November 2018 to cover India's advances in fields relevant to S&T Diplomacy.[11] [12]

This study seeks to situate the role of S&T Diplomacy in Indian foreign policy by both benefiting from previous scholarly attempts and contributing originally to the subject area through its own unique approach, meant to fill the gap in the sparse but already existing body of academic research. This research benefits from an original research question, hypothesis and aims and objectives — which instantly set it apart from other previous studies in terms of *originality*.

The research also focuses on two full case studies — resulting in detailed focus on the S&T component of the country's development cooperation programme and its space programme — instead of attempting to answer many cases in mild detail, as has been attempted previously. S&T Diplomacy's overall role in India's foreign policy is also pursued, studied, and factored in the body, recommendations and conclusion of this research in detail.

Also, this research departs from previous academic treatments of India's S&T Diplomacy by drawing from a far greater wealth of primary evidence and secondary sources. This study further takes meticulous note of the defining factors and unique characteristics of the Indian foreign policy environment in the 21st Century, which is important since the same S&T Diplomacy theory would yield different outcomes for a different state with its own foreign policy designs. This unique mix of elements grants originality to this study.

Research Design and Limitations

The *design* of this research involves crafting an original research question with duly supported hypothesis and then conducting examination of existing and emerging evidence against this background to arrive at studied inferences. The rationale behind the research question and accompanying hypothesis have been duly established in the previous sections.

[11] Research and Information System for Developing Countries (2020). *Development Cooperation Review*. Link: https://bit.ly/3bD8sPh . Last Accessed on 9 March 2021.
[12] Research and Information System for Developing Countries (2020). *Science Diplomacy Review*. Link: https://bit.ly/2VBVVGk . Last Accessed on 9 March 2021.

It is in this section that the rationale behind the research design and the strategy are established.

The core research component of this study remains a perusal of both *primary* and *secondary* evidence for arriving at inferences given the research question and hypothesis. According to Booth, Colomb and Williams (2008: 69-70), primary sources include authentic original documents or other material from a given research area which enable a researcher to test a hypothesis or an argument. Lamont (2015: 80-81) states that many primary source documents are stored in archives — and require access to be availed, studied and interpreted. Official documents, in particular, present a researcher with issues of limited access and — in some cases — outright denial of access. Furthermore, primary documents related to a subject area may not necessarily be housed in a single, compact location. In terms of IR research questions with a wider subject area, primary source documents are generally dispersed across various geographical locations encompassing different organizations.

This study avails primary sources from archives such as *Foreign Affairs Records* — maintained by India's Ministry of External Affairs between 1955 to 1999 — and volumes such as the *India's Foreign Relations - Documents*, detailing India's IR record in the 21st Century under the editorial direction of the former Indian diplomat Avtar Singh Bhasin. The study also benefits from online archival material held at the Indian Prime Minister's Office; President of India's Office; Press Information Bureau; Ministry of External Affairs; and National Archives of India. Information from Indian Parliamentary Committees and departments such as the Department of Science and Technology also inform this research. Outside India, the documents availed for research originate from sources such as Wilson Center Digital Archives and the US Office of the Historian. Online access to a vast majority of these sources has mitigated the challenge of lack of access impeding research efforts for this study.[13]

This research also relies on secondary evidence. Secondary sources include published material which may have itself relied on primary sources to reach researched conclusions.

[13] See Appendix 1 for a comprehensive list of online primary sources and resources for the study of Indian foreign policy.

These sources also enable a researcher to test the research hypothesis against prevailing academic opinion or consensus. In some cases, a secondary source can also act as a primary source if its core postulates are being measured against a wider debate in a comparative analysis, particularly in historical studies which compare older sources (Colomb and Williams 2008: 69-70). However, a researcher has to be cautious of the nature of the secondary sources chosen for the study since a number of these sources may contain either bias or inadequate/ineffective research methods affecting the quality of their overall conclusions (Pierce 2008: 82-83; Lamont 2015: 80). Secondary sources form the backbone of the theoretical and conceptual frameworks that guide this study.

This thesis further takes a comprehensive two-pronged *case study approach* to avoid falling in previously-established patterns that apportion mild attention to multiple cases whilst avoiding details. Employing the Case Study Research (CSR) approach for this study has its rationale. Gillham (2010: 1-5) notes that CSR helps a researcher to situate a research through a potentially wide area of cases — including human beings, institutions, communities and professions. Furthermore, a researcher does not have to limit the research effort to the findings of a single case but can choose to pursue multiple cases instead. Yin (2003: 1-2) notes the prevalence of the CSR strategy in disciplines as diverse as psychology, sociology, economics and political science — cementing the role of CSR as a widely accepted and used research tool. Woodside (2010: 1-3) states that CSR is not limited to contemporary and ongoing phenomenon and can also be applied in historical context to give rise to meaningful research. However, the core element of CSR — according to Woodside — is the importance that a researcher places on the case, which is also the justification to make a larger argument in terms of a meaningful scholarly contribution.

The vast nature of India's international S&T engagement to safeguard its national interest opened the way for this study to analyze India's S&T Diplomacy through the prisms of a wide variety of cases such as information and communication technology (ICT), nuclear technology, energy security, military technology, cyber security, hydro-power, high-technology trade, health, food security, infrastructure, space, financial technology, agriculture, education, fisheries/marine sciences and polar studies. However, the research

ultimately had the option of either focusing on a peripheral level on a vast number of multiple cases — as had been attempted before — or to treat selected cases in greater detail.

In terms of selecting cases for this study, India's external engagement in areas such as nuclear technology, military technology and energy security was found to already have a credible degree of existing academic literature devoted to the subject areas.[14][15][16] On the other hand, areas such as polar and oceanic studies had issues in terms of formulating representative cases. The country's external engagement in frontier areas of S&T Diplomacy such as cyber security, financial technology, high-technology trade is also emerging with the full implications set to attain greater clarity in the coming years. India's external engagement in areas such as ICT, agriculture, food security, fisheries/marine sciences, hydro-power, education, infrastructure and health were found to have a high-degree of overlap with the country's development cooperation programme.

This study seeks to situate India's S&T Diplomacy in the 21st Century mainly through the S&T component of its development cooperation programme and through its space programme. The *justification for selecting the cases is thus*: India has pursued both since its independence and the areas have been *constant* in the country's efforts to safeguard its national interest. India — as a state — has provided capacity building initiatives for human resource development to its counterparts in the Global South and had embarked on a path of development diplomacy briefly after its independence in 1947 in efforts to aid its future rise as an emerging global power (Saxena 2016: 2; Ministry of External Affairs, Government of India 2014; Abrol 1989: 36). In the 21st Century, the prevalence of S&T in the Indian

[14] For nuclear technology see: Rai, A. K. (2009). *India's Nuclear Diplomacy after Pokhran II*. New Delhi: Observer Research Foundation & Pearson Longman; Pant, H. V. (2011). *The US-India Nuclear Pact: Policy, Process, and Great Power Politics*. New Delhi: Oxford University Press; Pant, H. V. and Joshi, Y. (2018). *Indian Nuclear Policy*. New Delhi: Oxford University Press; Joshi, Y. and O'Donnell, F. (2018). *India and Nuclear Asia: Forces, Doctrine, and Dangers*. Washington, DC: Georgetown University Press.

[15] For military technology see: Chellaney, B. (1999, ed.). *Securing India's Future in the New Millennium*. New Delhi: Centre for Policy Research & Orient Longman; Cohen, S. P. and Dasgupta, S. (2010). *Arming Without Aiming: India's Military Modernization*. Washington, DC : Brookings Institution Press; Basrur, R. M.; Das, A. K.; Pardesi, M. S. (2013). *India's Military Modernization*. Oxford: Oxford University Press.

[16] For energy security refer to: Dhall, V. (2013). *India's Energy Security*. New Delhi: United Service Institute of India & Vij Books — and Pant, G. (2015, ed.). *India's Emerging Energy Relations: Issues and Challenges*. New Delhi: Springer. For more recent comprehensive studies see: Sharma, A. (2019). *India's Pursuit of Energy Security: Domestic Measures, Foreign Policy and Geopolitics*. Los Angeles: Sage — and Pradhan, S. K. (2020). *India's Quest for Energy Through Oil and Natural Gas: Trade and Investment, Geopolitics, and Security*. Singapore: Springer.

development cooperation programme had become so dominant that the country's incumbent President Ram Nath Kovind stated that India had 'placed science and technology at the center of its development cooperation strategy' (Kovind 2018).

Similarly, India had sought to engage with states such as the US in the area of space S&T since the 1950s (Daniel 1992: 488-489). Both the utilitarian and soft power implications of the Indian space programme have been acknowledged at the highest levels of the Government of India by Vajpayee (2002; 2003); Singh (2005); and Modi (2018) — all of the country's serving PMs in the 21st Century.

The core *limitation* of this study exists in the condition that the research originally sought to also benefit from a numerically significant and diverse set of original primary interviews for reaching inferences but was ultimately unsuccessful in achieving that objective.

This study originally sought to partially rely on structured interviews from the elite demographic segment to avail additional information on the subject of India's S&T Diplomacy. Pierce (2008: 117-118) states that structured interviews enable the researcher to ask the same set of questions to different subjects — following the template derived from pre-designed questionnaire(s). Furthermore Pierce (2008: 119) situates the elites in terms of political research in the UK as 'people who exercise disproportionately high influence on the outcome of events or policies' in a research area. These according to Pierce (2008: 119) may be "ministers, Members of Parliament, senior civil servants, business leaders, union leaders, members of think tanks or financial institutions, learned commentators, journalists, local councilors, chief executives, 'gatekeepers' etc." Pierce (2008: 119) cautions that to seek information from the political elites, a researcher should be prepared to address the issues of access, confidence and planning — all of which play a role in the ultimate success of the elite interview strategy.

This research attempted to draw additional information from the scholars in Indian IR and S&T studies. Questions posed to experts adhered to a structured interview format corresponding to key points in the research.[17] However, even after having initiated contact with several established experts between June-August 2019 for primary research purposes,

[17] See Appendix 2 for copies of primary research questionnaires.

the response in terms of numbers of respondents was found to be frustratingly sparse. Most respondents cited issues of expertise or availability. The research also saw assurances of response which never actually materialized. Hence the primary research response for this study is limited to Lele (2019a; 2019b), Nagao (2019), Selvamurthy (2019a; 2019b), Bagla (2019) and Varshney (2019).[18]

This limitation was brought to the attention of the supervisors between August-September 2019, and it was decided by the research team that the PhD candidate was to return to London and work towards a preliminary draft to be completed using all existing and available textual evidence and then proceed to finalize and finish the draft through inputs from primary research workshops to be held in India as instructed by the secondary supervisor of the research project in September 2019. The preliminary draft took between September 2019 to March 2020 to take a discernible shape but by then a further round of fieldwork had also become increasingly fraught with risk as the outbreak of the Coronavirus (COVID-19) pandemic firmly took hold through much of the world — including India and the UK.

The Government of the United Kingdom (2020) — on 23 March 2020 — enforced a nationwide lockdown requiring all people except critical workers or those in need to stay at home and not gather in public. There were reliefs stipulating that people could step out of their homes for essential activities such as shopping for necessities, exercises, medical needs, and even for work if absolutely required. However, such a lockdown ultimately meant that the research fieldwork could not enter a second stage as international travel from the UK to India had also become fraught with grave risk to both the researcher and the respondents.

[18] At the time of primary research for this thesis, Dr. Ajay Lele served as a Senior Fellow in India's Manohar Parrikar Institute for Defence Studies and Analyses. His profile can be accessed via this link: https://bit.ly/2QvOFM2 . Dr. Satoru Nagao served as Non-Resident Fellow at the Hudson Institute — based in Washington, DC — with a profile that can be accessed here: https://bit.ly/2QcWMgF . Dr. William Selvamurthy served as the President of the Amity Science, Technology and Innovation Foundation, whilst holding other eminent responsibilities (https://bit.ly/3gdhKGY). The thesis also benefits from the input of the David Perlman Award for Excellence in Science Journalism winning science journalist and author Pallava Bagla (https://bit.ly/2Q9ibr9). Input from the Indian establishment also figures in primary research with Dr. Sanjeev Kumar Varshney contributing to the thesis with his analysis as the incumbent head of the International Cooperation Department, DST, GoI (https://bit.ly/3tqDN0F). Full audio transcripts of primary research have been shared with thesis supervisors but can yet not be released in the public domain given data privacy concerns of interviewees and consequent ethical constraints.

The advent of virtual meetings and interviews had not taken hold by then and the world had yet to see the arrival of functional vaccines or even a semblance of normalcy that would follow in the months ahead. These extraordinary events have caused a *noteworthy limitation* in the form of lack of access to a second round of research fieldwork *despite abundance of existing primary and secondary sources* to credibly support the research backbone of the thesis.[19] The research is still informed by a small number of eminent respondents from which the study has gained valuable insight. The small number of interviews might be seen as a *limitation*, a condition to be *ethically reported* as such.

Chapter Summary

Science and technology have historically influenced international relations — yet the relationship of S&T with national interests, diplomacy and foreign policies of states remains understudied and poorly understood till date despite eminent exiting scholarly studies and notable academic advances in the field of S&T Diplomacy. India as a rising power stands to benefit particularly from increased academic attention on its S&T Diplomacy given a declared intention, capability and pursuit of the same — and also given a paucity of scholarly attention on the subject.

This research is thus aimed at situating the role of S&T Diplomacy in India's foreign policy in the 21st Century through the S&T component of its development cooperation programme — which is the dominant component of the country's development cooperation strategy — and through its storied space programme, which still remains an unlikely success story for a developing state, granting the rising power unique capabilities for conducting diplomacy in the international system which are discussed in greater detail in Chapter 4 of this study.

The research relies on primary sources, secondary sources and also attempted greater primary research for addressing relevant questions albeit the primary research component

[19] Other issues such being physically distanced from the university's main research environment and the financial and psychological stress endured through being amidst a region affected adversely by COVID-19—and their consequences on research output—are beyond the scope of the main text since this may constitute a universal phenomenon being encountered by most contemporary researchers across the globe.

remains limited to a modest extent due to the ongoing COVID-19 pandemic. The writing of the research has itself been impacted — like many other researches around the world — by constraints imposed by the unforgiving nature of the pandemic. However, an attempt to study and situate the subject has yet been made despite existing adverse conditions.

Chapter 2: Science & Technology Diplomacy and India's Foreign Policy in the 21st Century

This chapter of the thesis outlines the core concepts and facts that inform this research. At the onset, all readers and reviewers must be appraised of the permanent condition that the *theoretical contours* — meant to inform all subsequent analysis — rightfully exist in *all* the four sections of the chapter, and this condition is given even beyond this chapter and *spills over* to the opening portions of the subsequent chapters for more depth in analysis. This chapter also consists of the core *Literature Review* backbone of the analysis — and pursues both primary and secondary sources for reaching theoretical directions ahead.

The chapter begins by first familiarizing the reader with the theory, frameworks and hypotheses that relate Science and Technology (S&T) to International Relations (IR) — and then goes on to situate vital aspects of S&T and foreign policy environments unique to India. The chapter then provides a brief outline of the evolution of S&T Diplomacy in Indian foreign policy to situate the country's past experiences and current directions in this field.[20]

Science, Technology and International Relations: Conceptual Frameworks and Hypotheses

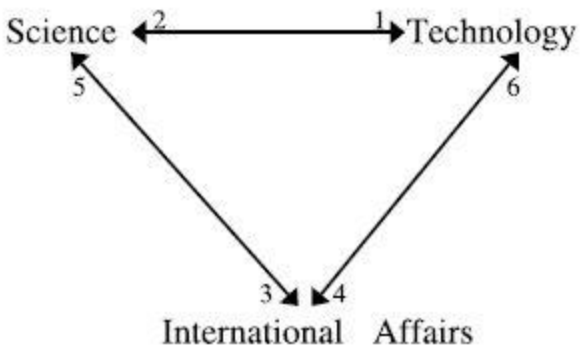
The relationship between science, technology and International Relations — despite scholarly attention to it being of only of recent provenance yet evolving in magnitude — dates back to a time well before the rise of the contemporary international system. Copeland (2016: 631) contends that although the terminology *Science Diplomacy* emerged during the 1990s the practice of actions now associated with the terminology has an actual history dating back to not only to modern nation-states but to ancient empires of the Near East,

[20] As with any other research on any other subject — more layers of theory for subsequent perusal in the analysis could have been added in *all sections* of this thesis chapter. However, university-mandated constraints adhering to realistic word limits require well-defined parameters. Much more could always have been added or even subtracted from all of the following sections given the benefit of hindsight. But this research is ultimately an PhD thesis with not only its own ambitions but also inherent limitations. Thus these are the core parameters as per specifications guiding this thesis.

China, India and Greece — with each political entity seeking to utilize advances made in key areas of S&T such as engineering and medicine to secure strength and durability through human history. Turekian (2018: 5) also notes that although the term *Science Diplomacy* gained prominence only in the 21st Century, the relationship between science and diplomacy itself has a lengthier history of its own.

Turekian (2018: 5) states that links between science and diplomacy become even clearer during the 18th and the 19th Century and notes that the Royal Society created an office for the Foreign Secretary years before inception of a national Foreign Office in the UK. Copeland (2016: 631) also notes that the appointment of Henry Oldenburg as the Royal Society's first Foreign Secretary — coming in 1723 — was years ahead of the appointment of the country's first Secretary of State for Foreign Affairs. Stine (2009: 1) situates Benjamin Franklin and Thomas Jefferson as the United States of America's first *scientific diplomats* due to their extensive scientific interactions in Europe during their diplomatic tenures through which they gathered and brought back scientific and technical knowledge that would go on to shape the development policies of a young and emerging US. Situating the role of S&T as a *constant* in shaping human history, Copeland (2016: 631) points to the centrality of S&T in the unfolding of some of the most pivotal chapters in human history such as European colonization, the two World Wars and the Cold War.[21]

[21] For example, Turchetti (2020: 430-432) maintains that obduracy in US diplomacy in terms of sharing the details of its nuclear progress and prowess with even its wartime allies during the Second World War, including not only the Soviet Union but the UK, gave rise to the two competing visions in post-Second World War era, with consequences lasting to the Cold War. And these comprised of a vision where nuclear technology had to be contained in the international system given its hard-power implications and another which focused more on peaceful international nuclear science and technology cooperation.



The relationship between Science, Technology, and International Affairs — as illustrated by Weiss (2005).

The 21st Century saw major advances in scholarly efforts seeking to situate the relationship between science, technology and International Relations. Weiss (2005: 297-299) situated the relationship between science, technology and international affairs in the present century through a 'triangle of double-headed arrows' (illustrated above). According to the construction forwarded by Weiss, advances in science lead to consequent advances in technology and the converse is also true. Weiss (2005: 298) further contended that advances in science give rise to knowledge that shapes policy and sets international agendas in areas where decision-making is influenced by scientific input, such as climate change. Weiss (2005: 298), contends that states in the international system may embark upon engagement with other states in the many areas of science — and this engagement has the potential to give rise to international agreements or international disagreement depending upon the situation and the context.

Weiss (2005: 298) also states that technology has an effect on international relations as technological advances made in key areas such as warfare are potentially capable of altering existing international dynamics. Weiss noted that the diffusion of technology also comes with proliferation risks in areas such as weapons of mass destruction and that the tangible nature of technology paves the way for competition between states in areas such as armaments and space. Weiss also held that the capacity of a state to create and manage technological innovation is a key determinant of its economic and political power. Weiss

(2005: 298) further argues that the innovative capacity of a state relies overwhelmingly on its 'scientific and technological institutions and the policies explicitly affecting them'.

Weiss (2005: 299) sees that public opinion, foreign policy objectives and inter-state relations influence the finance, environment and priority aspects of S&T in a state. Furthermore, he sees that international cooperation is key to determining the viability of vital aspects of innovation — such as the global Intellectual Property Rights (IPR) system. In a state, Weiss argued that S&T advances also depend upon the demands of the domestic and global market — and on political, economic, legal and social factors. Weiss (2005: 299) asserted that S&T impacts international relations by impacting its operational processes, substance, architecture and the ideational dimension.

Flink and Schreiterer (2010: 665) also acknowledge that science, technology and international relations affect and influence each other in the contemporary age of high globalization and further posit that national policies of states have to take into account the S&T developments emerging from elsewhere, particularly from their rival states.

Flink and Schreiterer (2010: 665) state that: 'apart from strengthening a nation's knowledge and innovation base, international scientific cooperation comes to be seen as an effective agent to manage conflicts, improve global understanding, lay grounds for mutual respect and contribute to capacity-building in deprived world regions.' Flink and Schreiterer (2010: 665) also state that 'the more a nation's prosperity and economic success hinge on its ability to tap into global resources and to attract talent, capital, support and admiration, the better it is advised to look for strategies to use its R&D assets most effectively to secure competitive advantages.'

Flink and Schreiterer (2010: 669) situate the rationale of Science Diplomacy as providing access to researchers to S&T advances beyond their national geographical confines for achieving either national or international objectives and for promoting a state in the international system for its advancements in S&T — which may in turn raise the state's capacity, performance and reputation further by securing international collaboration for increased innovation. Flink and Schreiterer (2010: 669-670) further situate Science Diplomacy as having an influence on how a state is viewed by its counterparts in the

international system — depending upon how well a state manages to assimilate different actors from both within and outside its geographical confines to address its national objectives and shared global challenges.[22]

As noted above, the term *Science Diplomacy* has come to denote the relationship between S&T and diplomacy in the 21st Century (Copeland 2016: 631; Turekian 2018: 5). Writing on the subject of *Science Diplomacy in the 21st Century*, Nina V. Fedoroff (2009: 9) — former Science and Technology Adviser to the US Secretary of State — states that 'Science diplomacy is the use of scientific collaborations among nations to address the common problems facing 21st century humanity and to build constructive international partnerships.' In an influential commentary published in the journal *Cell*, Fedoroff (2009: 9) dwells upon her own past experience in working with Russian scientists to assert the 'profound stabilizing influence that scientific interactions can exert between countries with deeply discordant ideologies and political systems.'

Fedoroff (2009: 10-11) calls attention to the common challenges facing humanity in the 21st Century — such as food security, disease and climate change — and calls for a 'paradigm shift' in interactions between the states from the Global North and the Global South, emphasizing on constructive partnership along idealist lines instead of a more realist aid diplomacy between states. Fedoroff (2009: 11) believed that such a paradigm shift may already have been in place in 2009 with governments, businesses and academia making the differences between the developed and the developing world clearer for the global audience.

Copeland (2016: 629) — while stating that a universally accepted definition of Science Diplomacy yet remains elusive — also acknowledges the conceptual framework advanced by Fedoroff (2009: 9) as a standard definition of Science Diplomacy. Copeland (2016: 629) further acknowledges the stabilizing influence of S&T between states of discordant

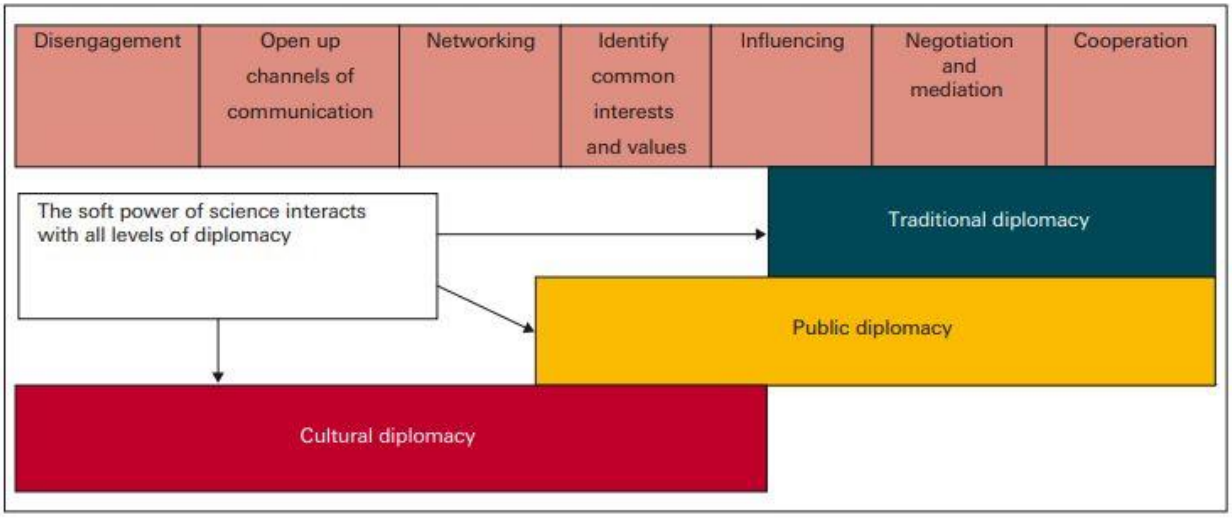
[22] Zewail (2010: 204-205) noted the asymmetry between the developing and the developed world in terms of wealth and living standards, and went on to suggest that sustainable development arises from science and technology — which enabled the rise of both the US and Europe. Zewail (2010: 205-206) also sought provision of S&T from developed countries such as the US to aid in the capacity building of the developing world, with particular emphasis on the Islamic world. Zewail (2010: 205-207) contended that following US President Barack Obama's 4 June 2009 Cairo speech — in which the American head of state articulated his intention of building bridges with the Islamic world through S&T — conditions were ripe for US to pursue Science Diplomacy in the area to not only serve mutual interests of peace and development but to also build goodwill.

ideologies and differing political agendas by citing examples of Western scientists collaborating with their Russian, North Korean, Cuban and Iranian counterparts to address areas of common concerns such as polar, atmospheric and health research.

However, Copeland (2016: 630) also advises against mistaking Science Diplomacy for generic international cooperation in the realm of S&T. As per Copeland, the distinction between Science Diplomacy and generic international S&T collaboration lies in the fact that Science Diplomacy involves state interests and not those of research advances alone. Copeland (2016: 630) states that 'when these interests diverge, the outcomes may be asymmetrical, particularly if broader negotiations are involved. In other cases, interests and objectives converge.'

Copeland (2016: 630) further cautions against an overly idealist approach to the subject by asserting that Science Diplomacy is, in practice, quite capable of being harnessed for achieving non-peaceful objectives set by states — a representative example being that of several states with foreign policies being averse to the US-led international system benefiting from the nuclear expertise of Pakistan through the country's Abdul Qadeer (AQ) Khan network. Copeland (2016: 630) acknowledges that S&T 'offer keys to security and development' but also states that it is capable of 'generating insecurity, environmental devastation and war.'

Copeland (2016: 629) further contends that constructing *Science Diplomacy* as a unified term with implications enjoying academic consensus might yet be premature, and — despite acknowledging the limitations and the overlaps — presents the term as having three distinct dimensions: *Science in Diplomacy*; *Diplomacy for Science*; and *Science for Diplomacy*. This construction advanced by Copeland (2016: 629) has its roots in outputs resulting from a comprehensive meeting hosted by the UK's Royal Society in partnership with the American Association for the Advancement of Science (AAAS) — held in London between 1-2 June2009 — with inputs from experts from across the Global South and North, which gave rise to the seminal paper *New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power*, published jointly by The Royal Society and AAAS in January 2010 (The Royal Society and AAAS 2010: I-V).



The soft power of science, as illustrated by The Royal Society and AAAS (2010).

The Royal Society and AAAS (2010: 5-8) situate *Science in Diplomacy* as scientific input informing foreign policy objectives such as food, water and energy security for states to function in the international system in a sustainable manner. This dimension of Science Diplomacy includes scientific input from not only the domestic sources within a state but also findings from credible international and inter-governmental organizations such as the Intergovernmental Panel on Climate Change (IPCC). Science in Diplomacy relies upon policymakers implementing inputs from the scientific community to frame national and international policies on a periodic basis. Policymakers at both the state and the multi-lateral level thus need to have either effective scientific acumen themselves or access to credible input from human resources with scientific proficiency to work meaningfully in this dimension. Moreover, scientists also have to make their findings known to the foreign policy community for an effective synergy.

Diplomacy for Science — as per The Royal Society and AAAS (2010: 9-10) — seeks diplomatic effort for meeting national or international scientific objectives in collaboration with other states in the international system. Science can help facilitate inter-state ties where states seek a common objective and can enhance mutual contact, which can in turn lead to enhancement of bilateral or broader multilateral ties. Furthermore, this is one of the key

mechanisms for states seeking to address common challenges such as climate change to work together for common security. This dimension also views inter-state competition as short-sighted, and questions whether national priorities or shared common challenges should take precedence in the decision making of states.

Science for Diplomacy — the third dimension of Science Diplomacy per the construction forwarded by The Royal Society and AAAS (2010: 11-14) — draws upon science to build inter-state ties through elements of international diplomacy such as S&T agreements and institutions with an emphasis on *soft power* of science. This dimension seeks to nudge states towards common S&T objectives through diplomatic tools such as educational scholarships, track two diplomacy or through science festivals and exhibitions. In select instances, The Royal Society and AAAS (2010: 12) notes that 'cooperation on the scientific aspects of sensitive issues may sometimes be the only way to initiate a wider political dialogue. The soft power of science, and the universality of scientific methods, can be used to diffuse tensions even in *hard power* scenarios, such as those relating to traditional military threats.'

The utilitarian aspect of the influential construction forwarded by The Royal Society and AAAS (2010) was later challenged by Gluckman et al. (2017), who — in their paper *Science Diplomacy: A Pragmatic Perspective from the Inside*, published in the December 2017 volume of *Science & Diplomacy* — argued that it was more suited for academic discussion rather than application on a practical level by a state or international agencies. Instead of framing Science Diplomacy as *Science in Diplomacy*; *Diplomacy for Science*; and *Science for Diplomacy* — Gluckman et al. (2017) sought an alternative framing of the concept 'that better resonates with government agencies.'

The three categories of Science Diplomacy as postulated by Gluckman et al. (2017) include: *Actions designed to directly advance a country's national needs*; *Actions designed to address cross-border interests*; and *Actions primarily designed to meet global needs and challenges.* Linking Science Diplomacy to state interests, Gluckman et al. (2017) assert that 'for a country to make any investment that supports science diplomacy, the actions must be seen to either directly or indirectly advance its national interest, but that national interest can be parsed according to motivations and intervention logic.'

Per Gluckman et al. (2017) *Actions Designed to Advance Domestic Needs* can include states exercising soft power through their S&T assets to build inter-state ties — with representative examples being that of the American S&T outreach to the Islamic World during the Barack Obama administration or Israel's efforts to reduce tensions with its Middle Eastern counterparts through the attractiveness of its S&T infrastructure. Gluckman et al. (2017) note the centrality of the S&T component in global development cooperation programmes and contend that S&T ties have the potential to further both trade and other, broader strategic state interests depending upon the context. Gluckman et al. (2017) also link national security priorities of states — including disaster management, health cooperation, arms control and cybersecurity — to this category of Science Diplomacy. As per Gluckman et al. (2017), states may also engage in S&T cooperation with other states based on economic priorities and may seek to invite foreign participation for shaping critical domestic STI infrastructure for national development and security requirements.

Gluckman et al. (2017)'s second category of Science Diplomacy — that of *Actions Designed to Address Cross-Border Interests* — is based on the assumption that a state's national interests can often lie beyond its geographical boundaries, and many of these interests can be addressed through cooperation in the field of S&T. Gluckman et al. (2017) note that — given the existence of shared natural resources across political boundaries — issues such as water management and marine sciences often require a joint addressal by multiple states in absence of which there is potential for the rise of inter-state disputes. States can also seek to harmonize aspects such as food safety and industrial standards to ensure greater synergy between domestic and foreign goods and services, paving the way for enhancement in critical areas of inter-state ties such as trade.

Actions Primarily Designed to Meet Global Needs and Challenges is the third category of Science Diplomacy advanced by Gluckman et al. (2017). This category assumes that global issues — such as climate change and sustainable development — require global responses. This dimension seeks to harmonize a state's national interest with international priorities, institutions and norms — which, in turn, requires recognition from both the S&T and diplomatic communities of a state that a collective response to global issues is in the national interest of the state. Given the lengthy and often opaque processes required to collectively

address global issues, Gluckman et al. (2017) advice stronger linkages between domestic S&T and foreign policy advisers as well as domestic S&T advisers and international agencies such as the United Nations (UN). Gluckman et al. (2017) draw attention to challenges emanating from ungoverned spaces from the polar, space, cyber and oceanic spheres and note the role of Science Diplomacy to effectively address them.

Copeland (2016: 630) notes the disparity between states in terms of S&T — and consequentially Science Diplomacy — capacity. Copeland asserts that while technologically advanced states with a sound economy from the developed world such as the US and the UK might possess the ability to engage other states across a wide spectrum of Science Diplomacy, several states from the developing world simply lack the overall wherewithal to emerge as *donors* of S&T in the international system — and may become *consumers* of S&T originating from outside their borders instead, often accepting S&T through development cooperation programmes. In Copeland (2016: 630)'s view, even financially sound states such as Switzerland or New Zealand are better categorized as *specialists* in a small range of S&T activities, which limits their ability to conduct Science Diplomacy on the same scale as their other counterparts from the developed world, such as France.[23]

Yakushiji (2009: 1) situates S&T activity as 'the most important human activity for building sustainable societies and resolving the problems of the Earth's finite resources.' Writing in the context of Japan, Yakushiji (2009: 1) notes that S&T 'has formed the backbone of Japan's development assistance policies' across continents such as Asia and Africa. Yakushiji (2009: 1-2) further notes that the phrase *Science and Technology Diplomacy* is new and allows for conscious application of S&T as a resource for diplomacy for Tokyo — also serving to create inter-disciplinary human resources across fields of diplomacy and S&T. Drawing upon the Japanese Council for Science and Technology Policy's reports on S&T Diplomacy, Yakushiji (2009: 2) found that the reports 'regard science and technology as diplomatic resources that serve to increase Japanese soft power.'

[23] The theoretical contours of states pursuing power via alliances in the international system also becomes pertinent at this point. Walt (1990) - in his *The Origins of Alliances* - points towards the limitations of common ideology, foreign aid or political penetration in building alliances in the international system. Walt suggests that states in the international system tend to balance more *against threats* instead of *balancing against power* for optimally securing their own national interests.

Yakushiji (2009: 3-5) distinguished between S&T Diplomacy and generic international cooperation by stating that 'the use of cutting-edge Japanese science and technology to make a contribution in the developing nations increases Japan's soft power. This represents a major difference between science and technology diplomacy as policy innovation and the science and technology cooperation in which Japan has been engaged in the past.' Yakushiji (2009: 6) also links advancement in S&T Diplomacy to Japan's pursuit of great power status in the international system.

Paarlberg (2004: 143-145) notes that the US by 2000 had fallen short of achieving its goals of producing world leader students in science and mathematics as set in 1990. As per Paarlberg, human resources from within the American education system had yielded uncompetitive results when compared to other states in the international system or even whilst meting domestic benchmarks by late 2000 in key areas of S&T — a pattern that might have been in place since the mid-1970s. However, the US — as a state in the international system — continued to maintain its overall global hegemony in terms of S&T advances by attracting and assimilating STEM human resources from across the international system to aid its national interests. This trait of perpetually attracting human resources from other STEM-inclined states such as India — has resulted in American dominance as a leader in global S&T despite internal deficiencies as per Paarlberg (2004: 143-145).

Sharma and Varshney (2019: 11) note that 'Science Diplomacy has been identified as a potential tool to strengthen or improve relations among nations, addressing global issues and exchange of resources where Science, Technology and Innovation (STI) has been identified as an engine of the social and economic progress and also a driver of globalization.' But the authors also caution that 'scientific dimension of diplomacy is powerful only if the tools promoting it are effective.'

Moomaw (2018: 78-80) notes that Science Diplomacy is borne out of human effort, and for it to be feasible the human resources involved in the processes are required to address aspects of both science and diplomacy effectively. Moomaw points towards the term *diplomat scientists* to denote scientists assuming diplomatic responsibilities and also the term *scientist diplomats*, in which diplomats cultivate scientific acumen. Without ascribing any precedence to either over the other, Moomaw — through an analysis of Science

Diplomacy meant to address global issues such as ozone depletion and climate change — puts forth that both scientific and diplomatic communities will have to learn from each other and build common capacity to arrive at timely solutions to address critical global issues.

S&T in India: A Brief Appraisal

Since independence, S&T activities in India have been guided by four national policies but have also been impacted by smaller, more intermittent, initiatives taken by the Government of India (GoI). The first of national policy to lay the foundations of S&T development in India was the *Scientific Policy Resolution* of 1958, which sought to cultivate scientific research in India to lead to a consequent flow of technology that would contribute to the country's national development (Sikka 2018: 3-4). India's first Prime Minister (PM) Jawaharlal Nehru — in his address to the country's Science Congress on 21 January 1959, soon after releasing the Scientific Policy Resolution in the previous year — stated his own 'outstanding interest in science' and further remarked that he realized that science was important to the world and, particularly to countries like India (Nehru 1959: 1). Nehru noted the potential of science in bringing a swift end to many of humanity's common longstanding challenges but also noted with alarm the rise of the destructive power of science, which culminated in introduction of new issues such as the advancement in technology for weapons of mass destruction (Nehru 1959: 2-7). Nehru further declared that India sought science for addressing its national development issues and for enabling its own rise — and sought international cooperation in science with no intention to be drawn into inter-state rivalries or competition (Nehru 1959: 2-3).

The second major S&T policy in India came in the form of the *Technology Policy Statement* of 1983, which emphasized on technological competence and national self-reliance (Sikka 2018: 3-4). Despite a heavy Indian focus on achieving self-reliance in terms of S&T through much of the 20th Century, both the Indian National Congress — in its 1969 *Draft Resolution on Science and Technology* (pp. 98-99) — and the country's government via its Technology Policy Statement, 1983 sought to acquire S&T from international sources. Noting that India required both foreign and indigenous technology, the Ministry of Science and Technology,

Government of India (1983) — in the Technology Policy Statement — distinguished between self-reliance and self-sufficiency, and sought to benefit from international advances in S&T by acquiring and absorbing useful foreign technology in the country's national interest. In 1991, India had embarked upon economic reforms and had inched closer towards embracing a market economy model, beginning its rise in the international system. India also saw a revolution in Information and Communication Technology (ICT) by the end of the 20th Century, which would result in the country's ICT industry gaining global prominence (Mallik 2016: 40-42).

India's first national policy to combine both science and technology in a single, coherent and comprehensive framework was the *Science and Technology Policy* of 2003 (STP 2003), which stressed on the need for enhanced investment in Research and Development (R&D) and also called for aligning existing socio-economic programmes in India with S&T to address the country's national issues. STP 2003 further called for the creation of a National Innovation System in India. However, STP 2003 would soon give way to the more ambitious *Science, Technology and Innovation Policy, 2013* (STI 2013) — the current national policy which guides all S&T activities in India — after just a decade. STI 2013 catered to India's aspirational goals for rapid inclusive and sustainable growth — and the rise of India as a global power in the international scientific and technological landscape. It further sought to foster strategic partnerships through international cooperation in STI by deploying Science Diplomacy, Technology Acquisition and Technology Synergy models 'based on strategic relationships' (Sikka 2018: 3-4; Balakrishnan 2017: 28-29).[24] It is also worth mentioning that Article 51A (h) of the Constitution of India holds that it is the fundamental duty of every citizen of the republic 'to develop the scientific temper, humanism and the spirit of inquiry and reform'. This measure — meant to encourage scientific learning in India — was taken in 1976, when the country's parliament introduced the 42nd amendment to its Constitution

[24] By the end of May 2020, the GoI had embarked on a six-month consultation process for formulating a *Science, Technology and Innovation Policy (STIP 2020)*, which — when it comes into effect — would become the fifth and most influential S&T policy in the Republic of India (Press Trust of India 2020a). The contents of the policy are yet to be fully determined and finalized. However, the Press Trust of India (2020a) quotes Dr. Ashutosh Sharma — incumbent Secretary, DST — as having stated: 'The STI policy for the new India will also integrate the lessons of COVID-19, including building of an 'Atmanirbhar Bharat' [self-sufficient India] through ST&I (Science and Technology and Innovation) by leveraging our strengths in R&D, design, S&T workforce and institutions, huge markets, demographic dividend, diversity and data.'

defining the fundamental duties expected of its citizens, not to be enforced by the writ of the state (Bakshi 2011: d).

More recently, India has also seen the inception of other key national S&T initiatives such as the Innovation in Science Pursuit for the Inspired Research (INSPIRE), *Skill India*, *Startup India*, *Digital India* and *Make in India* programmes. In a bid to spur innovation to address national development challenges, the Government of India (GoI) — through union cabinet decisions taken in February 2018 — approved implementation of the *Prime Minister Research Fellows (PMRF)* programme for seven years beginning in 2018-19 with funding of over 245 million USD, and extended the existing *Impacting Research Innovation and Technology (IMPRINT)* programme to IMPRINT-2 phase, with funding of over 155 million USD. GoI's other recent STI initiatives include the setting up of a National Knowledge Network — meant to connect approximately five thousand S&T nodes through an advanced pan-Indian network — and the *National Innovation Council*, meant to spur innovation to address the country's national issues such as health, energy, infrastructure and water security (Balakrishnan 2017: 28-29; India Brand Equity Foundation 2019: 7-21).

In India, the Ministry of Science and Technology (MOST) headed by a Union Minister of Science and Technology is the apex body for formulation and implementation of the country's S&T policies. The Department of Science and Technology (DST) — housed within the MOST — further has the powerful Office of the Secretary, DST which heads the country's Scientific Division, Boards and Autonomous Institutes Division. The Secretary, DST is directly answerable to the Union Minister of S&T. The DST — as the most influential arm of the MOST — further maintains a parliamentary unit that is entrusted by the MOST to discharge parliamentary functions on its behalf. The DST's parliamentary unit enables the oversight of parliamentary committees to India's S&T institutions by facilitating visits and further liaisons with other legislative and executive bodies for ensuring accountability (Department of Science and Technology, Government of India 2019a: 285-288; Department of Science and Technology, Government of India 2019c). Since 1948, India has benefited from a system of Scientific Advisory Committees — meant to provide input to elected representatives on matters related to policy and prioritization of the country's S&T. India's political leadership

has also sought regular dialogue with the country's S&T community through conferences such as the annual meeting of the Indian Science Congress (Sikka 2017: 28-30).

India had 993 universities in 2018-19, which have contributed to its S&T workforce being the third largest in the world. It is the third most productive state in terms of volume of science and engineering publications globally. Over the last decade, India has risen globally as an offshoring destination, with the number of established multi-national R&D centers growing from 721 in 2010 to 1150 in 2018 (India Brand Equity Foundation 2019: 3, 12-13). India's Gross Expenditure on R&D (GERD) has also seen a steady increase in actual terms from 241.17 billion Indian Rupees (INR) in FY 2004-05 to 853.26 billion INR in FY 2014-15. In terms of Purchasing Power Parity, India's GERD reached 50.3 billion USD in FY 2014-15, ahead of the 40.2 billion USD in FY 2009-10 with the country accounting for approximately 2.7% of the global share in GERD between FY 2014-15 to FY 2016-17 (Department of Science and Technology, Government of India 2017: 1-19).

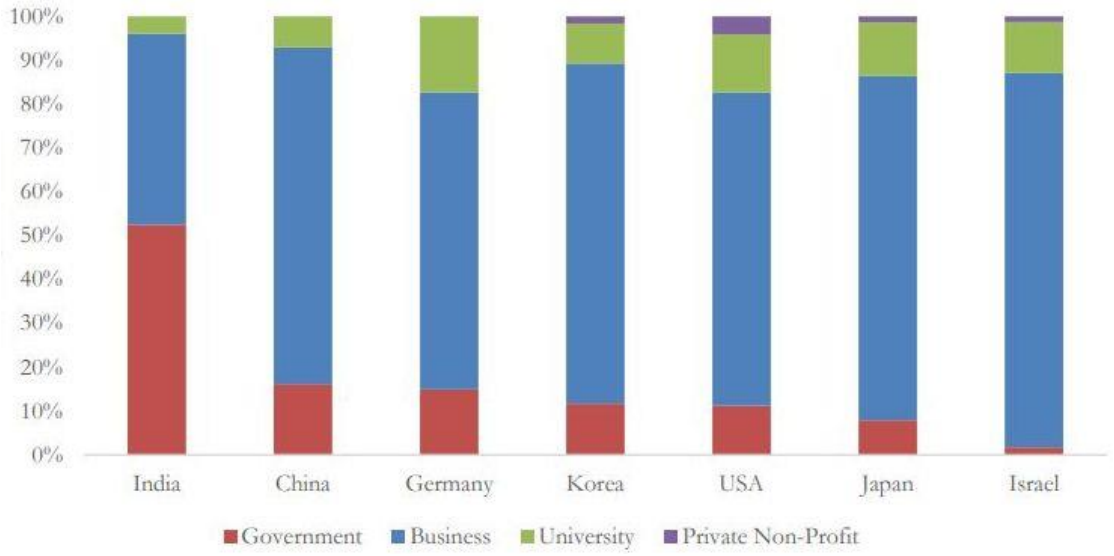
India increased the number of its researchers per million of its population from 110 in 2000 to 218 in 2015. And the country's R&D expenditure per researcher stood ahead of Russia, Israel, Hungary, Canada, Spain and the UK in FY 2014-15. India's scientific publication output has also increased from 62, 955 in 2009 to 1,06,065 in 2013 — ahead of the global average for the same time period. Despite difficulties in the patent regime, India stood at the 7th rank in terms of patents filed in 2015 — ahead of Russia, Canada and Brazil — according to World Intellectual Property Organization (WIPO) statistics (Department of Science and Technology, Government of India 2017: 1-19).

Vajpayee (2003) — in his formal state address to the 90th session of the country's Science Congress — noted several issues that existed within India's S&T mix that impeded both domestic socio-economic growth and global contributions. The first was a disconnect between science and policy in India in an era where India's S&T held an increasing bearing on its economy, national security and development. Vajpayee situated policy-making in the 21st Century as being complex and inadequately addressed by a single discipline of knowledge — and called for a multidisciplinary approach with scientists and technologists providing inputs on key areas of Indian policy and Indian policy-makers seeking to avail and implement such inputs. Vajpayee also called for greater participation of the private sector in

India's R&D in collaboration with its universities and public sector institutions for the country to become more competitive in the international system. Vajpayee recognized the potential of R&D developments that originate from outside of India's formal S&T mainstream, and sought to gain their potential through means such as the National Innovation Foundation. However, the tenacity with which some of the issues mentioned in the Indian PM's speech made nearly two decades ago have held firm in the Indian S&T ecosystem would turn out to be remarkable.

In the *Economic Survey 2017-18*, the Ministry of Finance, Government of India (2018c: 119-120) notes the country's long history of contributing to S&T advances but also notes that — given India's rise as a major economy — there is scope for improvement in the fundamentals of India's approach towards S&T if the country seeks to transition from 'being a net consumer of knowledge to becoming a net producer'. The Ministry of Finance, Government of India (2018c: 120) states that India 'cannot rest on its past laurels' and emphasizes the need to reinvigorate S&T to address challenges of national interest such as development, social progress and national security — including human security and environmental security.

India's net R&D expenditure as a fraction of its Gross Domestic Product (GDP) has rested well below 1% since FY 1990-91, peaking to only about 0.85% in FY 2008-09. These figures are not adequate to support the rise of India since most developed states in the international system devote at least 2% of their GDP to R&D. Moreover, in terms of R&D expenditure as a fraction of its GDP — India, which spent 0.69% of its GDP on R&D in FY 2014-15, fared well below all its counterparts in the BRICS grouping with the closest tally to South Africa, which had spent 0.73% of its GDP on R&D in the same FY (Department of Science and Technology, Government of India 2017: 1-19).

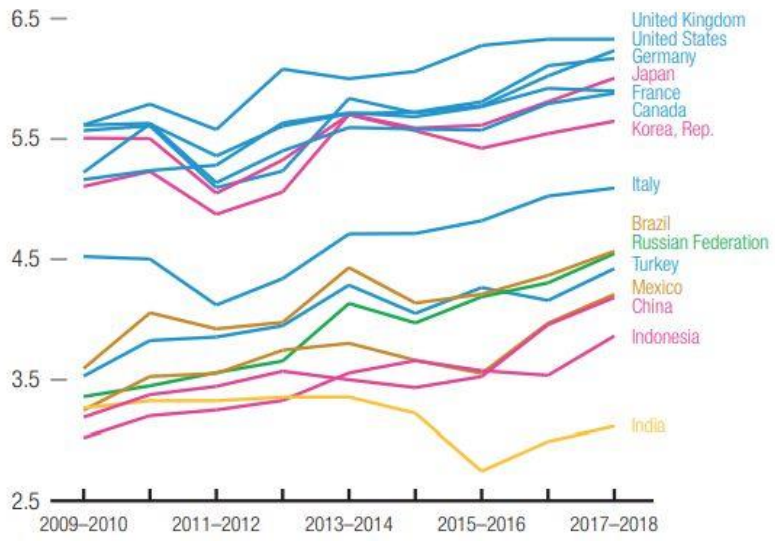


Gross Expenditure on Research and Development (GERD) by performer share, 2015 (UNESCO figures appropriated by the Ministry of Finance, Government of India 2018c).

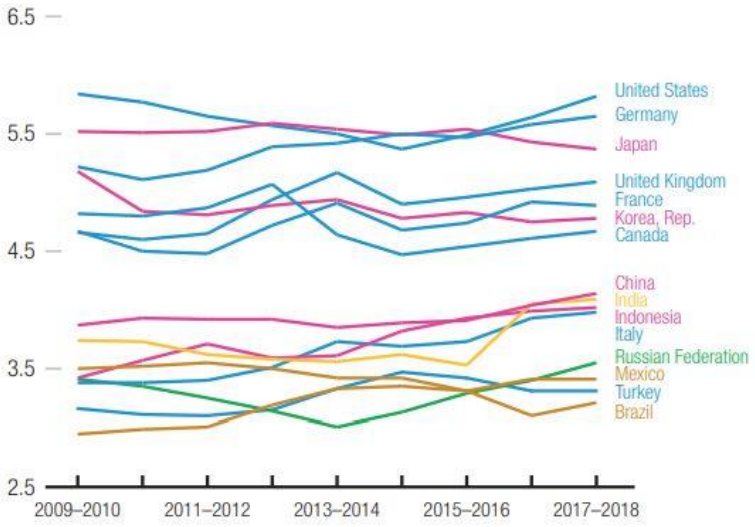
Investment in S&T in India also comes primarily from the central government and the state governments lack participation in STEM investment, even for answering local challenges unique to state jurisdiction. The Central government in India acts as both the main source and destination of its R&D funding — unlike states such as China, Germany, Japan, Israel, South Korea and the US where the Gross Expenditure on R&D (GERD) is dominated by the business sector. Furthermore, India's public investment on R&D suffers from disproportionate allocation of funds — with its agencies specializing in areas such as nuclear energy, space technology, earth sciences, S&T and biotechnology accounting for over 60 percent of the country's public sector investment (Ministry of Finance, Government of India 2018c: 120-127).

India's universities act more as institutions of higher education rather than acting as active research hubs integrated with the country's public and private sectors for achieving S&T output of national value. The country's labyrinthine, understaffed and lethargic bureaucratic system has also led to Indian innovators filing their patents in foreign offices abroad rather than filing them in their home country, impeding STEM innovation attributable to the country (Ministry of Finance, Government of India 2018c: 122-126).

With the relatively recent prevalence of the internet since the 1990s, India had withstood a major technological disruption along with that which later came with the rise of the smartphone in the 21st Century — despite the core centers of innovation being located in either the West or in China. However, with the advent of disruptive technology in terms of Artificial Intelligence (AI) taking shape — India presently stands unprepared and potentially threatened, vulnerable to losing its position as a prominent rising power in the international system (Aggarwal 2018: 17-18). Despite the launch of its ambitious *Big Data Initiative* — meant to promote big data S&T in the ICT sector across government, private sector and academia — in 2016 and more recent plans for establishing multiple Cyber-Physical Systems hubs and a National Artificial Intelligence Centre, India has ultimately fallen behind other states in management and creation of new technologies in the ICT sector (Aggarwal 2018: 17-18; India Brand Equity Foundation 2019: 22-23).



Technological readiness in large advanced economies and large emerging economies between 2009-10 and 2017-18 (World Economic Forum 2017).



Innovation environment in large advanced economies and large emerging economies between 2009-10 and 2017-18 (World Economic Forum 2017).

Due to its exiting limitations, India is ranked at 68 out of 141 in the World Economic Forum's *Global Competitiveness Report 2019* — ahead of Brazil, Egypt, Iran and Pakistan but also below Mexico, Indonesia and South Africa. India's economic growth in the contemporary period has been marked with a bearish trend and the country faces challenges in terms of ICT adoption despite improvement in transport, electricity and infrastructure. There are further issues of market liberalization, health and skills that impede India's overall global competitiveness. However, India's innovation — according to the Global Competitiveness Report 2019 — is 'well ahead of most emerging economies and on par with several advanced economies' (World Economic Forum 2019: XIII-16).

Paarlberg (2004: 143-145) states that India spends approximately 15-20 thousand USD per candidate to earn due specialization in S&T from its own institutions. Since enhanced enabling of H-1B visas gained approval of the US Congress in 1998 — thousands of fully trained, professionally sound Indians have entered the US STEM system to aid the country's global leadership in S&T whilst also saving the country's domestic taxpayer the cost of training. However, what is favorable for the US STEM ecosystem might also be a loss for India given a condition of drain of talent away from the home state to other foreign states. Vajpayee (2003) asserted that the conditions to retain credible S&T talent to aid the

country's national efforts remained thin and thus a significant component of the country's S&T workforce actually preferred migrating away from India in favor of professionally serving in other states, creating both *brain-drain* and a scientifically inclined Indian diaspora in the process. Vajpayee (2003) remarked on the role of bureaucratization in impeding India's S&T progress and mentioned that virtues such as merit and collective effort should prevail over seniority and individualism for promotion of talent in India's S&T ecosystem. The Indian PM also situated brain-drain as being closely associated with India's ossified bureaucratic culture. Vajpayee also sought to craft means of attracting this workforce back to the state of their origin.

The Ministry of Science and Technology, Government of India (2020: 49-50) states that 'as for the engagement with Indian diaspora is concerned, the policy direction is to create a fine balance between attracting the best talent back home and creating facilitating channels for the diaspora to contribute in national development from wherever they are. Appropriate institutional mechanisms and suitable opportunities will be created to engage with the Indian diaspora more effectively.' The GoI seeks to create a more suitable environment for attracting skilled human resources from its diaspora back to India whilst also ensuring that the diaspora that remains outside of the country's geographical confines also contributes in its best capacity to the country's S&T advances. Ministry of Science and Technology, Government of India (2020: 49-50) seeks to focus on preventing further brain-drain and to attract skilled workers to the country through the networks and connections aided by the Indian diaspora.

Despite limitations, India's unique S&T mix now grants the rising power sufficient capabilities to respond to global challenges during times of unexpected crises. One such crisis originated in November 2019 when the antecedents to the ongoing COVID-19 pandemic, caused due to the novel SARS-CoV-2 virus, first emerged in Wuhan, China. The virus then spread to the rest of the world causing over 100 thousand untimely deaths and two million confirmed cases well within April 2020. Responses by both states and intergovernmental organizations to the COVID-19 pandemic were marked by chaos and confusion instead of coordination partially since initial information from Beijing was itself marked with opacity and consequently led to both a delay in other states securing their

travel to and from China and a tragically belated World Health Organization (WHO) declared Public Health Emergency — which came as late as 30 January 2020. WHO also declared COVID-19 as a pandemic much later on 11 March 2020, and by that time most states in the international system were already faced with a novel medical emergency within their borders with little existing wherewithal and logistics to answer to this new challenge to their national security (Balakrishnan 2020: 6).

Although the SARS-CoV-2 virus was ultimately novel in 2020, it still belonged to a larger coronavirus group which was previously the cause of the 2003 Severe Acute Respiratory Syndrome (SARS) outbreak and Middle East Respiratory Syndrome (MERS) outbreak in the 2010s — pandemics which had been contained with tragic fatalities but also without causing an enduring damage to much of the international system. However — occurring in the information age — the COVID-19 pandemic led to disinformation and xenophobia even as several states in the international system attempted to enforce restrictions on travel, education, mass gatherings and even work with varying degrees of success (Balakrishnan 2020: 6-7).

Ellis-Petersen (2020) situates India as the largest supplier of pharmaceutical drugs worldwide and also the producer of over half of the global vaccine supply — earning it the informal moniker of the 'pharmacy of the world'. Biswas (2020) notes India's three-decade long history of cooperation with the US in developing vaccines, and points towards American intentions to develop vaccines to address the COVID-19 pandemic in partnership with India.

In terms of vaccine production, Biswas (2020) notes that the Serum Institute of India 'makes 1.5 billion doses every year' and 'supplies some 20 vaccines to 165 countries'. And further has 'an extra capacity of 400 to 500 million doses'. The Serum Institute of India — the largest producer of vaccines globally —partnered with UK's Oxford/AstraZeneca project, which enjoys UK government support, to mass produce COVID-19 vaccines. Indian private sector companies such as Bharat Biotech also partnered with the American firm FluGen, the University of Wisconsin-Madison, and Washington University to add to the ongoing global attempts to mass produce COVID-19 vaccines. Indian pharmaceutical firm Biological E partnered with Johnson and Johnson to produce up to 500 million vaccine dosages. And Russia looked towards Dr. Reddy's for seeking to conduct human trials of Moscow's Sputnik

vaccine in India — and to produce up to 100 million doses of the vaccine (Biswas 2020; Ellis-Petersen 2020).

Marlow et al. (2021) contend that it is this ability to rapidly and manufacture credible vaccines that has granted India a unique opportunity amidst the ongoing global pandemic to secure greater influence and enable its own rise in the international system. Marlow et al. note that — even prior to the COVID-19 pandemic — India was already an established supplier of essential medicines to the Global South. Moreover, during the ongoing crisis India emerged as not only a prime manufacturer of vaccines which originated from elsewhere — such as the Oxford-AstraZeneca vaccine — but also developed its very own vaccines, most notably culminating in Bharat Biotech's Covaxin. Marlow et al. contend that this capacity, and a political will to assist other countries in their own vaccination efforts through provision of Indian manufactured vaccines, has enabled the country to address its foreign policy objectives such as countering growing Chinese influence originating from Beijing's own vaccine diplomacy.

However, growing requirement for vaccines from within and external constraints originating from outside would serve to impede India's designs to emerge as a net provider of security to its international partners amidst the ongoing pandemic. By late March 2021, New Delhi temporarily curbed exports of the AstraZeneca vaccine given paucity of raw materials required to manufacture COVID-19 vaccines following the incumbent Biden administration's invocation of the Defense Production Act in the US to restrict the export of such materials in favor of Washington, DC's own domestic compulsions. Disruptions in supply chain conditions given needs of its own population fluctuated India's outbound commitments to provide vaccines internationally (Menon 2021).

Diplomacy and Foreign Policy: Defining Factors and Unique Characteristics of the Indian Environment

Basrur (2014: 171-172) situates India prior to the end of the Cold War and the beginning of its economic reforms as a *relatively weak state* in the international system with a leadership role resigned largely to Third World groupings such as *Non-Aligned Movement* (NAM) and

the *Group of Seventy-Seven* (G77) — with an added role in United Nations peacekeeping operations. As per Basrur (2014: 172-173), India's state behavior *on the whole* — despite the demonstration of nuclear weapons capability in 1974 — was marked by its preference towards multilateral engagement and suspicion of major powers with an emphasis to secure maximum autonomy for itself in the international system.

After having suffered colonialism as a part of the British Empire, a newly-independent India under its first administration led by Jawaharlal Nehru viewed capitalism as espoused by the western powers with suspicion. India would later seek to lead the Global South in its bargaining efforts with the Global North for collective development of the developing world during the 1970s. The most notable departure from India's commitment to the principle of non-alignment during the Cold War came in the form of the *Indo-Soviet Treaty of Friendship and Cooperation* of 1971, which led to an enduring tilt towards the Soviet Union. Early Indian foreign policy also came to focus on the principle of *self-reliance* to a degree of autarky inspired by the Soviet Union. During the Cold War, India — despite a tilt towards the erstwhile USSR — sought to avoid an overly significant dependence on any single state for its technological requirements and preferred to favor multiple sources of technology with the one notable exception being China, against which the country had suffered a military defeat in 1962 and continues to have a territorial dispute till this date (Basrur 2014: 173-174).

Basrur (2014: 177) contends that India's brand of non-alignment had been internally challenged with the emergence of the *Janata Party* since 1977, which saw an over-reliance on Moscow away from Washington, DC as being against the core of the principle. Nascent attempts to build tangible ties with the US continued under the Indira Gandhi and Rajiv Gandhi administrations through the 1980s but could not take hold due to the prevailing external and internal circumstances — notably India's commitment to socialism and the US preoccupation with the Cold War. However, Basrur (2014: 177-178) asserts that by 1990, a series of factors would lead to a conclusive change in India's foreign policy towards the US. The first was a *balance of payments* crisis that had festered from 1985 and led the Indian government to introduce the economic reforms of 1991 — enabling India's economic rise; the second was the end of the Cold War and the breakup of the Soviet Union by 1991; and

the third was an overt Indian demonstration of nuclear power in 1998, which — after initial sanctions led by the US — also marked the full rise of India as a state that would be considered as a valuable partner in Asia by not only the US, which sought to balance China, but also other democratic powers such as Japan and Australia.

Schaffer and Schaffer (2016: 44-45) situate the end of the Cold War and the breakup of the Soviet Union as having met with mixed reactions from New Delhi. India's foreign policy community, while relieved that the likelihood of a major confrontation between two superpowers had now subsided, also looked at the decline of Russia and emergence of the US as the sole superpower with a degree of alarm. With the decline of Moscow and the emergence of a unipolar world order, India's foreign policy had to adjust to the changed realities.

Schaffer and Schaffer (2016: 43) further situate the emergence of economic reforms and the rise of coalition governments in the early 1990s as departure points for India's foreign policy. Schaffer and Schaffer (2016: 43) contend that several constants of Indian foreign policy have endured to the 21st Century. These are a conscious adherence to non-alignment — a term increasingly morphing to *strategic autonomy*; seeking regional primacy in South Asia; a commitment to the integrity of its territorial boundaries; and a will to build the national economy to project power.[25]

India's incumbent External Affairs Minister (EAM) S. Jaishankar — in his speech at the 4th Ramnath Goenka Lecture, delivered in on 14 November 2019 in New Delhi[26] — described

[25] Basrur (2017: 25) further found that Indian foreign policy under the first Modi administration was marked with continuity of the elements of *the use of power, diversity of security relationships* and *the pursuit of status* and — did not show evidence of a Hindu nationalist bias despite there having been ample evidence for the same in domestic policy. Basrur (2017: 25) notes that previous foreign policies under the INC administrations headed by both Indira Gandhi and Rajiv Gandhi had adopted far more aggressive postures towards security threats concerning India. Basrur (2017: 26) concluded by stating that India is unlikely to initiate major military actions beyond its borders unless pressed to do so — and that the country was unlikely to overtly commit itself to one side in the ongoing Sino-US rivalry.

[26] Rajagopalan (2019) calls the address delivered by Jaishankar (2019) 'brilliant and breathtakingly candid', and goes on to situate the 'unsentimental audit of Indian foreign policy' as 'a rare speech for any government functionary to make in any country'. However, Rajagopalan (2019) also notes that there are elements of continuity in Indian foreign policy — such as an imagined self-image of the country being in a unique position of offering attractive ideals to other states — that have persisted through decades without any notable success. Rajagopalan also points towards continuity in India's enduring relationship with Russia — noting Moscow's own dependence on New Delhi's rival Beijing. Rajagopalan further takes issue with Jaishankar's assertion on the international system becoming multipolar, since the US is still the sole superpower with China as a distant second — opening up the

the evolution of Indian foreign policy since the country's independence as having gone through 'six broad phases, each a response to a different strategic environment'. As per Jaishankar, the first phase from 1946-62 was an era of *optimistic non-alignment* — set in an international system dominated by two opposing powers. India, as a newly decolonized state, had to ensure maximum autonomy for itself while safeguarding its core national interests such as sovereignty, territorial integrity and economy in a bipolar world. Indian foreign policy was oriented towards leading the newly decolonized states and others from the Global South to ensure the rise of an international system that delivered according for the priorities of Third World states. This period of optimistic non-alignment in Indian foreign policy was brought to an end by the Sino-Indian Border War of 1962, which saw the South Asian giant humiliated in a military defeat by its East Asian rival in China (Jaishankar 2019).[27]

According to Jaishankar (2019), a second phase of Indian foreign policy — that of *realism and recovery* — came to fore in 1962 and lasted until 1971. During this period, realism instead of idealism dominated India's foreign policy, with the country concluding a short-lived defence agreement with the US in 1964 in a bid to put national security above its commitment towards non-alignment. During this period, Indian policymakers had to make pragmatic choices in face of domestic turbulence due to internal political tensions and a weak economy — and external challenges emanating from South Asia itself, culminating in a war with Pakistan over Kashmir in 1965. India still had to contend with a bipolar world

possibility for a bipolar world that would require a different strategy. Pant (2019) calls the audit offered by Jaishankar (2019) as conceptually granular and politically candid to the extent of becoming 'the central document through which Indian foreign policy will be assessed in the coming years'. Pant notes that the Indian EAM took stock of the limits of consistency in an active foreign policy meant to serve state interests. Pant also notes that the rapidly changing internal and external environments that enabled such a candid audit of foreign policy will also lead to Indian policymakers re-examining other long-held beliefs which may have now lost their utility.

[27] Pant (2016: 36) situates the Sino-Indian Border War of 1962 as one which was short in length but enduring in terms of impact on bilateral ties. India would soon see its idealist notions of Asian solidarity fade away, and would expedite its nuclear weapons programme after the first Chinese nuclear test in 1964. China, too, would enable Pakistan — India's perceived regional rival — in its efforts to develop nuclear weapons and to also fight conventional wars against the South Asian giant during the following decades.

although one in which both the US and USSR also managed to secure a limited amount of cooperation, including in their South Asia policy (Jaishankar 2019).[28]

The third phase of Indian foreign policy — that of *greater regional assertion* — emerged with the creation of Bangladesh and the dismemberment of Pakistan as an outcome of the *Bangladesh Liberation War* of 1971, which put an end to the notion of parity between India and Pakistan in the international system. The period also bore witness to an ill-fated Indian intervention in Sri Lanka in the form of the Indian Peace Keeping Force (IPKF), which operated from 1987-1990 — and Indian policy had to contend with a Pakistan now on closer terms with both China and the US. This phase continued until 1991 by which the Soviet Union — with whom India had signed a *Treaty of Peace, Friendship and Cooperation* in 1971 to balance the growing Sino-US rapprochement — had collapsed and New Delhi had initiated economic reforms in face of mounting fiscal crisis (Jaishankar 2019).[29]

The fourth phase of Indian foreign policy according to the construction forwarded by Indian EAM Dr. S. Jaishankar came with the fall of the Soviet Union and the end of the Cold War. The rise of the unipolar world with the US as its sole superpower led to a revisiting of several fundamental principles of Indian foreign policy in New Delhi. India sought to safeguard its strategic autonomy — and this had a bearing on its nuclear and trade policies even as the country increasingly opened up its economy for attracting investment from around the world. India formally established relations with Israel; instituted a *Look East Policy*; engaged the US for closer bilateral ties; and overtly demonstrated nuclear weapons capability by 1998. India's sustained economic growth managed to attract global attention — including that of the US which sought strategic partners of its own in an international system where multipolarity and Islamic fundamentalism had both convincingly emerged (Jaishankar 2019).

[28] Fair (2014: 188-190) notes that China's support to Pakistan during the Indo-Pakistani War of 1965 had both military and diplomatic dimensions even as the US refused to assist the efforts of either belligerent by suspending military aid to both countries.

[29] India's military efforts during the Bangladesh Liberation War would run into complications due to Richard Nixon administration's provision of military support to Pakistani armed forces despite US arms embargoes, existing since 1965, prohibiting such assistance. Military aid from the US would ultimately turn out to be insufficient to stop a determined India from achieving its objective of liberating Bangladesh from Pakistan's hold (Fair 2014: 182).

The fifth phase of Indian foreign policy emerged in the 21st Century and continued until 2014. In this phase, India's EAM S. Jaishankar (2019) situates the country as having gauged the changed post-Cold War nuances of an international system which had been marked with a more competitive global environment, and discovering 'the benefits of working with different powers on different issues' by 'gradually acquiring the attributes of a balancing power'. In the 21st Century, India embarked on a nuclear deal with the US and sought greater engagement with the west in general but also joined hands with China on issues such as climate change and trade. India also joined the BRICS grouping and consolidated ties with a post-Soviet Russia to cater to its own national objectives (Jaishankar 2019).[30] [31]

According to Jaishankar (2019), a sixth phase of Indian foreign policy took shape from 2014 onward. In this phase, Indian foreign policy meant to address China's assertive rise; a relative decline in the US's role as the world's sole superpower; and a Europe that had become increasingly insular in India's calculation. New Delhi responded to the emergence of 'a wider dispersal of power and more localized equations' by engaging in diplomacy guided by a notion that it had to contend with a 'world of convergences and issue-based arrangements.' Aware of the growth in economy, national power and a demographic that had become increasingly relevant for global technology — India sought to address emerging multi-polarity in the international system by shaping key initiatives of global interest such as the *Paris Agreement* on climate change while investing greater resources to its development cooperation programs meant for its partners in the Global South. Driven by the objective that 'multi-polar world should have a multi-polar Asia at its core', the Indian approach for this

[30] Menon (2016: 56-57) contends that the impact of the Indo-US civil nuclear initiative was greater than the sum of its parts. This was the first foreign policy initiative for which an Indian government had to face a no-confidence motion in the parliament. Re-defining the strategic partnership with the US, the initiative would provide the Indian state with more than just energy security or access to civilian nuclear technology. Menon (2016: 56-57) states that once the defining hesitations in an area as sensitive as nuclear technology were overcome, the two sides embarked on a much deeper level of cooperation in other areas such as dual-use technologies, defence cooperation, trade and S&T exchanges. Both sides would also go on to align their foreign policy responses in South Asia and beyond to largely suit each other's interests in the following years.

[31] In another, earlier theoretical construction — Sahni (2007: 21) situated the main drivers of a Rising India's foreign policy as 'quest for strategic autonomy; its aspiration to status transformation; its desire to play a role in shaping the global system; its need to access technology and bypass technology denial regimes; its hunger for energy; its regional imperatives; its search for a continental role; and its diaspora policy'. However, Sahni (2007: 21) also situated democracy, culture, geography, markets and norms as non-drivers of Indian foreign policy. Terrorism also finds only a brief mention in Sahni's construction.

recent era sought to work with 'multiple partners on different agendas' in pursuit of its own Great Power ambitions (Jaishankar 2019).

Hall (2012: 1098-1102) writes that — since independence — India's traditional approach to employing soft power as a component of its diplomacy has involved elements such as leveraging its democratic credentials and promoting cultural diplomacy, including the legacies of both Gandhi and Nehru. According to Hall (2012: 1099), post-independence India would improvise upon the British ideal of gaining international influence through public diplomacy by partitioning its own public diplomacy into 'cultural and academic exchanges; intellectual and research links; and state-funded media targeted at foreign audiences'. Independent India also sought to employ sports diplomacy — particularly in the field of cricket — to its advantage (Hall 2012: 1099-1102).

However, since the year 2000, Hall asserts that India has visibly sought to conduct public diplomacy beyond its well-honed traditional approaches. Hall (2012: 1102) writes that five new areas emerged as components of a Rising India's new public diplomacy in the 21st Century. These were: 'India’s effort to reach out to overseas Indians; its attempts to build connections with foreign business interests; its nascent foreign aid and development program; its use of major events to showcase and "nation-brand" India; and its use of new social media to reach out to younger, tech-savvy audiences.'

Hall (2012: 1102-1110) contends that these new components constituted a deliberate attempt by the Indian government to influence foreign audiences by going beyond the established and traditional channels of public diplomacy. Hall notes the S&T component of this new public diplomacy by noting India's high-technology assistance programs in Africa such as the *Pan-African e-Network* and India's technical assistance initiatives closer to South Asia, all bolstered by the increasing economic wherewithal that inevitably accompanied India's rise. Hall states that beyond the traditional aspect of *South-South Cooperation*, Indian diplomacy also sought to build linkages with the Global North by seeking the support of not only the political but the business segments of decision-makers and influences in states such as the US to secure landmark agreements in the history of Indian S&T Diplomacy such as the 2005 *U.S.-India Nuclear Agreement*.

Since 2000, India has also sought to upgrade its government websites and has further sought to spread its state narrative via online platforms such as *Facebook* and *Twitter*. Hall concludes that these changes in India's new public diplomacy may have partly been in response to earlier advances made by its Asian rival, the People's Republic of China but may also have other motivations independent of Chinese advances in public diplomacy, such as the growing awareness among Indian elite to harness science and technology for public diplomacy (Hall 2012: 1102-1110).

India — under the Manmohan Singh administration — had become increasingly cognizant of the overlap that existed between itself and the US in terms of foreign policy objectives in South-East and East Asia, and this trend continued under the incumbent Narendra Modi administration. A major part of 21st Century India's foreign policy in Asia has been the *Look East* component, which increasingly morphed to the *Act East* policy under the first Narendra Modi administration in 2014. India's pragmatic approach to balance a risen China led to growing ties with Japan. Enhanced ties with South-East Asian powers also promote India as a rising power in Asia (Pardesi 2019: 29-33).

In the 21st Century, India has increasingly taken to multilateral cooperation though there are exceptions. India has opposed China-led *Belt and Road Initiative* (BRI) — a portion of which passes through Pakistan administered Kashmir, which India claims as its sovereign territory — despite being nudged to join the initiative by its Cold War ally and current strategic partner Russia (Miglani 2017). India also withdrew from the Regional Comprehensive Economic Partnership (RCEP) in November 2019, citing unfavorable trade conditions. The China-backed grouping had the support of over a dozen states from Asia as well as Australia and New Zealand (Reynolds 2019). In November 2019, Reynolds (2019) reported that Hideki Makihara — the Deputy Minister for Economy, Trade and Industry of Japan, another prominent strategic partner of India — stated an intention to 'continue to try to persuade India to join' RCEP. Both examples point towards India's willingness to join international multilateral groupings but not against its self-interest.

Ray Chaudhury and Saha (2019: 49-50) contend that the notion of gaining primacy beyond its region and specifically in the *Indo-Pacific* — a strategic construct that focuses on geography stretching from Africa's eastern coast to Oceania, encompassing the Pacific Island

states — has gained prominence in Indian foreign policy since the first Modi administration. India has embarked on enhanced cooperation with multilateral groupings such as Indian Ocean Rim Association (IORA), the East Asia Summit (EAS), Association of Southeast Asian Nations (ASEAN) and the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC). Ray Chaudhury and Saha (2019: 49-50) also state that India's Indo-Pacific strategy increasingly overlaps with its Act East policy and the country's maritime interests have increasingly begun to take the geography of the Western Pacific into account, resulting in enhanced outreach to states such as Australia. India has also expressed interest in *quadrilateral* cooperation between itself, the US, Japan and Australia.

On 13 March 2021, the leaders of the US, India, Australia and Japan jointly published an op-ed in *The Washington Post* to outline the nature and the scope of the four-country quadrilateral cooperation — by now known popularly as the *Quad*. In the influential op-ed, Biden et al. (2021) trace the practical origins of the grouping to HADR operations during the 2004 Indian Ocean earthquake and tsunami, and further traced the ideational origins to common dialogue in 2007. Since 2017, the four-country grouping had begun exploring avenues for greater cooperation to ensure a free, open, secure and prosperous Indo-Pacific region. In the first apex level summit held on 12 March 2021, Quad leaders affirmed a commitment to jointly address issues such as climate change and the COVID-19 pandemic — including supporting and expanding India's vaccine production capacity to meet the demands of people across the Indo-Pacific region (Biden et al. 2021).

India's incumbent Foreign Secretary Harsh Vardhan Shringla — in his address *Broad Canvas of Indian Diplomacy During the Pandemic* to the Indian Council of World Affairs (ICWA), delivered on 4 September 2020 — situated the ongoing COVID-19 pandemic as 'the greatest shock to the international system since the Second World War'. Shringla (2020a) noted that the levels of change in terms of economy, geo-politics and social challenges induced by the pandemic were unprecedented in living memory except for the Spanish Influenza pandemic of 1918. Shringla also noted that — during the pandemic — border issues with China had also taken a kinetic turn, stating that: 'This is one of the most serious challenges facing us in recent years with casualities on this border after over 40 years.' Shringla (2020a) further situated the COVID-19 pandemic as 'a major geopolitical shock' with 'a long term impact on

world politics' leading to changes in the global balance of power — influencing India's existing foreign policy options. However, Shringla also reaffirmed that the country's *Neighbourhood First* policy will not change and that New Delhi seeks further momentum in its *Act East*, *Indo-Pacific*, *Think West*[32] and pro-Africa policies.

Since independence, the Republic of India has been governed by a democratic decision-making system with its own distinctive characteristics. While the Indian Constitution gives formidable powers to the President such as the individual assuming the role of the Commander in Chief of the Armed Forces — much of the actual authority in terms of governance rests with the Prime Minister and the central cabinet. The Indian government — after having conclusively demonstrated its majority on the floor of the lower house of the parliament beyond any doubt — does not need approval of the opposition for actions such as ratifying an international treaty or declaring a war. The idea of a demonstrable parliamentary majority has reigned supreme in India since independence except when the incumbent government in New Delhi has had to contend with loosely held coalitions (Cohen 2001: 68).

Pant (2016: 17-19) situates India's foreign policy structure as being more stable than many other states in South Asia, and notes that — unlike its neighbors Myanmar and Pakistan — the country has never experienced a military coup or a diminishing of civilian supremacy led by an elected government. Pant also notes that — unlike other vibrant democracies such as the US — Indian defence and foreign policy experts have a relatively meagre role in the making of India's defence and foreign policies since the country does not allow significant levels of lateral entry for independent experts to reach its policymaking apparatus. The apex institution that directs Indian foreign policy remains the Prime Minister's Office (PMO), with the Ministry of External Affairs (MEA) acting as the implementation arm for the policies set by the PMO (Pant 2016: 17-19).

[32] Shringla (2020a; 2020b: 8) situates the *Think West* policy as India's enhanced outreach to the Gulf and West Asian states. This policy should not be confused with the country's increasingly growing ties with the 'western world'.

The country's Prime Minister — and members of the PMO — have traditionally been involved in foreign policymaking but this aspect has been marked with variation in interest across administrations, with some Indian PMs choosing to become more involved in foreign policy matters than others. The same is also true for the country's External Affairs Ministers, which are also political appointees often with very little previous foreign policy experience (Pant 2016: 17-19).

India's National Security Adviser (NSA) enjoys direct access to the country's PMO and a powerful office in its own right. The country's key national institutions such as the Department of Atomic Energy (DAE) and the Ministry of Food and Agriculture also figure prominently in the country's foreign policy formulation. Ministries such as Environment, Health and Space have recently played an increasingly vital role in India's development cooperation programs. Much of the senior staff in Indian ministries comes from the Indian Administrative Service (IAS), which exerts greater influence than even serving members of the armed forces in the Ministry of Defence (Schaffer and Schaffer 2016: 82-84).

Both houses of the Indian parliament have members which can head key foreign policy institutions such as the MEA. However, the Members of Parliament (MPs) belonging to the political grouping in power exert more influence in the realm of foreign policy in comparison to their counterparts in the opposition (Schaffer and Schaffer 2016: 82-84). Since 1992, India institutionalized a system of multiparty parliamentary standing committees catering to issues of national significance which are chaired by a ranking member of the opposition — with the power to call serving functionaries of the state to testify on issues on national significance (Cohen 2001: 70). India's state governments, too, may provide input or play a role in matters of foreign policy which are vital to a specific state. Furthermore, India's vibrant media, business community and think-tanks also inform and help shape the country's foreign policy despite the lack of direct executive power (Schaffer and Schaffer 2016: 82-84).

Mattoo and Jacob (2010: 23-45) note that since the inception of the Constitution of India on 26 January 1950, New Delhi has held firm primacy in terms of designing the country's foreign policy — relegating its many provincial capitals to a status subservient to central control in varying degrees in terms of external engagement with other transnational entities in the

international system. However, since the country's 1991 economic reforms — a more decentralized increase in interaction between office-holders of India's states and foreign stakeholders came to fore under the auspices of the state organs of New Delhi.

Hazarika (2014: 33-42) states that — given the advent of coalition politics and economic liberalization in India — sub-national diplomacy emerged as a force to be noted within the country by the 21st Century. However, the writ of New Delhi ultimately remains unchallenged despite an increase in activity of its provincial actors to engage with foreign entities to address local needs. Jacob (2016: 1-19) contends that the first Narendra Modi administration in India since 2014 has enabled greater role of states in the country's foreign policy — significantly through the creation of a fully-operational *States Division* within the country's MEA for addressing areas including Foreign Direct Investment (FDI) and other economic interests. Despite these measures, the role of states in dictating national security concerns still remained under the firm grasp of New Delhi instead of state capitals. Per Jacob (2016: 1-19), there is still scope for a more robust engagement between New Delhi and India's provincial capitals for better serving the country's overall national interests.

Evolution of S&T Diplomacy in Indian Foreign Policy: A Brief Overview

India's Prime Minister Narendra Modi — in his address to the country's 102nd Science Congress — declared on 3 January 2015 that he had 'placed science and technology at the forefront of our diplomatic engagement'. PM Modi (2015a) stated that as a part of his visits abroad he had 'personally sought out scientists to explore collaborations in areas like clean energy, agriculture, biotechnology, medicine and healthcare.' Modi (2015a) further noted that: 'We have built excellent partnerships with all leading nations to address the grand challenges of the world today. I have also offered our expertise to our neighbours and other developing countries.' Although this articulation of policy is notable for its clarity — independent India already had a long history of placing S&T at the core of its diplomatic practice by the time the address was delivered in 2015.

The history of India's S&T Diplomacy is as old as the history of the diplomacy in the country itself. The *Report of the Ministry of External Affairs and Commonwealth Relations, 1948-49* — the very first report of its kind since India gained independence from the British Empire in 1947 — notes the role of the country's diplomatic mission in Tokyo as being 'particularly useful in securing facilities for India businessmen visiting Japan and in securing Japanese equipment and technicians for the development of Indian industries' (Ministry of External Affairs and Commonwealth Relations, Government of India 1949: 7).

The report also notes the utility of France as being capable of supplying India with steel, machinery, capital goods and chemicals and expected a trade delegation from the country to visit India after the holding of bilateral initial consultations. The report further notes India entering a *Treaty of Friendship and Establishment* with Switzerland on 14 August1948 — and states that Indian officials had already initiated contacts with Swiss industrialists with an intention to secure their cooperation for starting factories for machine tools, electrical goods and heavy machinery in India. The report anticipates the visit of a trade delegation from Belgium to India in December 1948 for a survey of India's commercial and industrial assets. The report also outlines that the India hoped for reaching an early Trade Agreement with Belgium, which would pave the way for enhanced technical and commercial ties (Ministry of External Affairs and Commonwealth Relations, Government of India 1949: 9-10).

The report goes on to laud the Indian mission in Berlin as being vital to 'recruiting approximately fifty German technicians and scientists for employment in various industrial projects in India'. In an early show of India's intention of benefiting from multiple sources of S&T while avoiding inter-state rivalries, the report also states that: 'Last year an Indian Trade Delegation visited Germany and a Trade Agreement has been entered into between India and the Western Zones of Germany. Negotiations for concluding a similar Agreement with the Soviet Zone are under way.' The report further noted the opening of India's first diplomatic mission in Stockholm, Sweden in January 1949 and situated Sweden as a state capable of acting as a source of advanced industrial technology to India (Ministry of External Affairs and Commonwealth Relations, Government of India 1949: 9-10).

India had also utilized S&T for its diplomacy since achieving independence. Ministry of External Affairs, Government of India (2014) notes that New Delhi had offered 70

scholarships for students from its counterparts in the developing world to pursue studies in India in 1949. The Ministry of External Affairs, Government of India (1950: 17) — in its annual report for 1949-50 — also noted that India expressed particular interest in the economic development of the under-developed countries in the UN's Economic and Social Council. The report (p. 9) also noted that India had sent a Scientific and Cultural Mission to Nepal in 1949 and had received a similar mission from Kathmandu by April 1950.

The antecedents to the Indian Lines of Credit also emerged as early as 1948 when India provided a loan of 75 thousand INR to Indonesia. During FY 1950-51, India provided a loan amounting to a million Pound Sterling (GBP) to Burma — now Myanmar — and went on to provide the country with an additional 42 million USD loan for its national objectives during the FY 1955-56 (Saxena 2016: 2).

Since the country's independence, Indian scientists had further contributed to high-value S&T agreements of global significance such as the Limited Test Ban Treaty (LTBT) — which benefited from the *Kothari-Krishnan-Parthasarathy Report* on the effects of nuclear explosions — and the Montreal Protocol, which relied on the *Kulkarni-Ramanathan Papers* on the vertical transport of Ozone in the atmosphere published in the late 1940s (Siddhartha 2017: 481-482).[33]

By 1950, India had signed the *Point Four General Agreement for Technical Co-operation between India and The United States of America* — its first major bilateral agreement in the domain of S&T — with the US (Government of India and the Government of the United States of America 1950). However, a newly-independent India had emerged as a state in the international system in an era where scientific and technical primacy was firmly in the hands of the Western World and the now erstwhile Soviet Union. As a state eager to deliver the fruits of S&T from the international system to its masses, India consciously took to the path of *non-alignment* amidst the prevailing US-USSR rivalry during the Cold War in its efforts to spur industrial growth in the interest of its own people. This path came with mixed blessings

[33] In the 21st Century, the now-seminal work *New Frontiers in Science Diplomacy: Navigating the Changing Balance of Power* published by The Royal Society and AAAS (2010) had also benefited from inputs from the senior Indian Science Administrator Dr. Raghunath Mashelkar in the form of *Science Diplomacy and Ever Changing India* held on 1 June 2009 as a part of discussions that led to the framing of final concepts encapsulated in the influential paper (The Royal Society and AAAS 2010: 30).

since the developed powers of the West saw no great benefit in enabling the rise of India, which had socialist leanings and a national objective of achieving *self-reliance* in terms of industry. The Soviet Union, despite its initial ambiguity, emerged as a major partner for India in terms of S&T for national needs during the Cold War (Nanda 2004: 51-52).

A defining instrument enabling India to utilize S&T for its diplomacy came to fore on 15 September 1964 in the form of the Indian Technical and Economic Cooperation (ITEC) programme — initiated as a decision of the Indian cabinet under PM Lal Bahadur Shastri. The annual scholarship positions offered by India under the ITEC/SCAAP initiative crossed the threshold of 10, 000 in 2013-14, with New Delhi offering over 280 courses across 47 training institutions in the country. The courses offered to selected candidates — mainly from India's counterparts in the Global South — include diverse areas such as Information Technology (IT), Small and Medium-Sized Enterprises (SMEs), energy, logistics, marine and aeronautical engineering, hydrography and rural development (Ministry of External Affairs, Government of India 2014).[34]

Parthasarathi (2018: 1601) states that India was a late arrival into the group of states consciously pursuing S&T for Diplomacy — with either a Minister or a Counselor being charged with the responsibility in the domain as a part of the country's High Commission in the UK in London by 1972. Since 1972, India posted Science Counselors to its embassies in the US, West Germany, Russia and Japan. Furthermore, India's inter-services tensions inherent to the country's environment also manifested abroad as the Indian S&T Counselors and bureaucrats of the Indian Foreign Service (IFS) sought to reconcile and harmonize their roles. For Indian S&T Counselors, a reliance on the S&T networks in India became important,

[34] India would also benefit from foreign collaboration in its own efforts to give rise to research institutions. Wittje (2020: 577-579) notes that — despite claims of all Indian Institutes of Technologies (IITs) being inspired by the Massachusetts Institute of Technology (MIT) — at least one such institute, the IIT Madras, drew not only inspiration from West Germany's *Technische Hochschule* but also aid for its establishment and later research support from Bonn. West Germany supported the effort partially because it wanted to match other foreign actors involved in providing research assistance to India — such as the Soviet Union, the UK and the US — in terms of goodwill and also to keep India's engagement with German Democratic Republic in check. IIT Madras later became a symbol of Indo-German ties that has seen high-level visits from both West and later unified Germany over the years (Wittje 2020: 577-579).

and required a balance that took both time and ambassadorial consideration in distant stations (Parthasarathi 2018: 1601).

Through much of its history, India's S&T Diplomacy has had to navigate a narrow balance between national priorities and addressing common international challenges. A representative example in which India's national priorities took clear precedence over the demands put forth to it by the international community came on 14 June 1972 during the Plenary Session of the United Nations Conference on Human Environment at Stockholm, when the country's PM Indira Gandhi voiced strong dissent against measures proposed by developed states for conservation of the global human environment. Gandhi (1972: 160-161) — while conceding that great harm had been done to the environment due to unchecked industrial activity — also invoked India's long history of being in harmony with nature. Gandhi (1972: 160-161) stated that India had taken its own steps to address environmental deterioration but also asserted that countries like India were bound 'by their own ideals' and had to answer to needs of millions of their impoverished citizens. Gandhi (1972: 160-161) asserted that it was unjust for states in the developed world to warn the developing states 'against their own methods' after having reached high stages of development through prolonged exploitation of not only their own natural resources but also of people from other countries during the long history of colonialism. Gandhi (1972: 160-161) asked: *Are not poverty and need the greatest polluters?*[35]

India has also had to respond to pressing technological advancements made in the external environment to address its own national interests through much of its history. The most notable example in this regard is India's response to the first Chinese nuclear weapons test on 16 October 1964. Following the first Chinese nuclear test at Lop Nur, the usually stoic Indian PM Lal Bahadur Shastri broke his storied silence on 22 October 1964 — in the

[35] India in the 21st Century would take several steps to address issues related to the environment and climate change — including signing the *Paris Agreement* on climate change and emerging as a key founding member of the International Solar Alliance (Sikka 2017: 45-47; Jaishankar 2019; Balakrishnan 2017: 213-216). However — given its dependency on conventional fuel and its ambitions to accelerate its rise, the country might find it difficult to optimally manage its climate change obligations made to its partners in the international system (Mallik 2016: 196-199).

presence of visiting foreign dignitary and Prime Minister of Sri Lanka, Sirimavo Bandaranaike — to express his alarm on the event.[36]

The chaos and confusion prevalent in India after the first Chinese nuclear test was not lost on other powers, including China itself. In a confidential cable to Beijing, the Embassy of the People's Republic of China in New Delhi (1964) noted that 'given the atmosphere of confusion and despair, talk in the political sphere and public opinion have now turned to the debate on whether India should develop atomic bombs.' The Chinese cable also noted — somewhat erroneously — that 'the American Ambassador in India hastily said that India need to conduct nuclear tests in the wake of our nuclear testing' (Embassy of the People's Republic of China in New Delhi 1964). India would soon find itself that the sentiment in Washington, DC was contrary to the secret Chinese apprehensions.

According to a *Memorandum of Conversation* drafted by the American diplomat David T. Schneider, the Indian Secretary of the Department of Atomic Energy Dr. Homi J. Bhabha had met with the US Under-Secretary of State George W. Ball in the presence of the Indian Ambassador to the US Braj Kumar Nehru, and the American diplomat Robert Anderson in Washington, DC on 22 February 1965. Schneider (1965: 188) — who was himself present in the meeting — notes that Bhabha had sought to consult the American side on Indian options following the first Chinese nuclear weapons explosion, only to be told by George W. Ball that the US expected 'major' non-nuclear states to set an example for others by not pursuing nuclear weapons themselves. Bhabha persisted with his argument by stating that China had benefited from Soviet expertise in nuclear weapons technology, and India could do the same in a very short amount of time given an American 'blueprint' but it might take an year and a half to demonstrate nuclear weapons capability with just its existing resources. According to Schneider (1965: 189-190) 'Dr. Bhabha stated that it was the policy of his government, with which he agreed, not to seek nuclear weapons. If his government is to justify this policy,

[36] Shastri (1964: 3-4): 'The recent explosion of an atom bomb by China has created a stir which is undoubtedly a matter of concern for all of us. However, we have always held the view that the use of nuclear weapons should be banned by agreement and all nations in the world should unite to save the humanity from destruction. I feel also that these countries who do not possess nuclear weapons, in Europe, Asia, Africa, etc. should unite and make a concerted effort to build up necessary public opinion. This should have an impact on the countries which are in possession of nuclear weapons. I must admit that we are passing through a most difficult period in international relations and we have to act wisely and as far as possible in cooperation with each other.'

however, ways must be found by which his country can gain at least as much by sticking to peaceful uses as it could by embarking on a weapons program.'

An alarmed India would persist with its peaceful civilian nuclear programme after the Chinese nuclear test of 1964 — facing internal opposition to fully commit itself to nuclear weaponization despite repeated Chinese nuclear tests through the early 1970s — but following the death of the pacifist Atomic Energy Commission chairman Vikram Sarabhai in 1971, the Indian victory in the Bangladesh Liberation War, and partially owing to domestic factors, the country's Prime Minister Indira Gandhi gave clearance to her scientists to prepare for a demonstration of nuclear weapons technology in 1972 (Anderson: 2010: 479-480, 488).

The first Indian nuclear test was ultimately carried out on 18 May 1974 and came with US-led sanctions for Indian nuclear technology that lasted for more than three decades. By then, the US-led sanctions had impeded the supply of critical material such as zirconium alloy components for India's nuclear reactors, even from neutral sources such as Japan. US-led sanctions also necessitated India's tilt towards the Soviet Union — which had refrained from overly criticizing India's nuclear tests and became increasingly important in New Delhi's calculations for securing nuclear technology. However, these sanctions also accelerated India's own innovation process in conditions of pressing urgency (Anderson: 2010: 10, 480-485, 497; Srinivasan 2002: 239-240).[37]

On 26 March 1982, in her address to the Science Policy Foundation in London, Indian Prime Minister Indira Gandhi (1982b: 102-103) invoked the relationship between science and statecraft in ancient India through the *Arthashastra* — a manual on statecraft traditionally attributed to the ancient strategist Kautilya — to note the relationship between science and governance in India's distant past. Gandhi (1982b: 103-104) noted India's many achievements in S&T throughout its long history but also noted that, in modern times, Europe had convincingly surpassed India in terms of S&T. Gandhi (1982b: 103-104) stated

[37] These sanctions were fully lifted by 2008, after both the US and Canada decided to enhance cooperation with a Rising India in the field of nuclear technology in principle by 2005-06 (Anderson: 2010: 10, 480-497).

post-colonial India had the benefit of pragmatic leadership under its first PM Jawaharlal Nehru to steer the country towards contemporary S&T research.

Gandhi (1982b: 105-106) noted that national progress of developing states depended upon their ability to integrate themselves to advances made in the international system and to absorb international technology through existing infrastructure. Gandhi (1982b: 105-106) stated that a pursuit of self-reliance by a state does not mean that a state seeks international isolation — but is rather translated to credible acquisition and appropriation of global S&T for independent national needs. Gandhi (1982b: 105-107) further stated that Indian attempts to achieve excellence in highly advanced fields of S&T such as nuclear and space sectors despite being a developing state yielded practical value to its ordinary citizens — who benefited by its climatic, oceanographic, mineralogical, agricultural and energy implications.

Shortly after the end of the Cold War and the beginning of the country's 1991 economic reforms, the relationship between S&T and foreign policy gained academic attention with the publishing of *Science, Technology and India's Foreign Policy*, authored by the scholar Sunil Sondhi in 1994. Beyond academia, Balakrishnan (2017: 292-294) charts the rise of S&T Diplomacy in Indian foreign policy to new developments in the late 1990s. The first development — as per Balakrishnan — was the establishment of the *Office of the Principal Scientific Adviser* to the Government of India (PSA, GoI) in the November of 1999. This office was tasked by the Government of India to device policies and strategies for the evolution of STI infrastructure in the country and to further serve as a Secretariat to the Indian *Scientific Advisory Committee* to the Central Cabinet with the PSA (GoI) as the Chairman. The Indian Ministry of External Affairs (MEA) further set up a *Division for Investment and Technology Promotion* in 1999 to address issues related to S&T (Balakrishnan 2017: 292-294).

In the present century, the Indian MEA has built upon this early progress to further the country's S&T Diplomacy through specialized divisions within the ministry such as the Cyber Diplomacy Division; Development Partnership Administrations I-IV; Disarmament & International Security Affairs Division; E-Governance & Information Technology Division; and the New Emerging & Strategic Technologies Division. In addition, the External Publicity & Public Diplomacy Division of the Indian MEA is also tasked with 'maintenance of official

MEA website and new media platforms' (Ministry of External Affairs, Government of India 2020a).[38]

On 4 January 2003, Indian PM Atal Bihari Vajpayee released the country's *Science and Technology Policy 2003* at the 92nd annual session of the Indian Science Congress held in Bangalore. The policy — which guided India's S&T activities from January 2003 until being superseded by *Science, Technology and Innovation Policy 2013* — sought 'to promote international science and technology cooperation towards achieving the goals of national development and security, and make it a key element of our international relations' (Ministry of Science and Technology, Government of India 2003: 103). India's STP 2003 also placed 'special emphasis' on 'collaborations with other developing countries, and particularly neighbouring countries, with whom India shares many common problems'. The STP 2003 further asserted that 'International collaboration in science and technology would be fully used to further national interests as an important component of foreign policy initiatives' (Ministry of Science and Technology, Government of India 2003: 111).

Siddhartha (2017: 481-482) notes that, for a state, both access and denial to S&T depend upon the foreign policy objectives of other states and organizations in the international system. India's Augmented Satellite Launch Vehicle (ASLV) experiment in 1987 contributed to the formation of the Missile Technology Control Regime (MTCR) — of which India became an early target. However, as the external environment became more conducive in the 21st Century the same MTCR granted India a full membership in 2016 with contemporary India now enjoying the privilege to allow or discriminate against its fellow states partially depending upon its own priorities. Furthermore, a shift in S&T research in the 21st Century — with net outputs increasingly moving away from the US and Europe to Asia — position India as a power which will increasingly need to consider its S&T collaborations in alignment with its foreign policy and national security requirements.

[38] Namdeo and Goveas (2020: 22) scrutinize the role of MEA's New Emerging & Strategic Technologies division — finding that it has been mandated by the GoI to better harmonize input from India's partners in the international system with the country's state actors, such as its various departments and ministries. The division is MEA's nodal point for all issues related to new and emerging technologies, and seeks to evaluate implications of emerging technologies for safeguarding India's national interests. The division will also negotiate on behalf of the GoI in multilateral forums and focus on emerging innovation with an eye on future S&T implications.

Siddhartha (2017: 481-482) also points out that some S&T collaborations carried out by India — such as its contribution to subsystem equipment to the International Thermonuclear Experimental Reactor (ITER) project in France; agreement to provide mirror actuators for the Thirty Meter Telescope (TMT) in the US; and agreeing for reciprocal use of facilities between its Giant Metrewave Radio Telescope (GMRT) in Maharashtra and the Arecibo Observatory are modes of scientific collaboration that carry foreign policy advantages in terms of soft power.

Siddhartha (2017: 481-482) further posits that a portion of India's international S&T engagement — such as its contribution to Laser Interferometer Gravitational-Wave Observatory (LIGO) experiment in which India links with the US at estimated cost of 20 billion INR — is meant more to advance the country's international image as a state with proven S&T capabilities rather than to cater to its basic national needs. Siddhartha (2017: 481-482) states that India's 2016 accession as an associate member of European Organization for Nuclear Research (CERN) may also have had more to do with politics than S&T. India already enjoyed high access to CERN — including access to its flagship Large Hadron Collider (LHC) project by 2016 — and had no pressing need to apply for the associate membership which also came with a 780 million INR per annum contribution. However, India's decision to join CERN may have been triggered by an earlier decision from its rival Pakistan to become the first Asian country to join the prestigious organization as an associate member.

During the second decade of the 21st Century, India became a part of more key multilateral export control organizations in the international system such as the Wassenaar Arrangement in December 2017and the Australia Group in January 2018. Membership to these fora enable New Delhi to both hone its own export control protocols and play a larger role in shaping the international multilateral export control regime meant to guide the responsible use of sensitive dual-use technologies. However, India's entry to the influential Nuclear Suppliers Group (NSG) is still pending mainly due to objections from Beijing despite

New Delhi having secured a waiver from NSG export regulations in 2008 (Sanders-Zakre 2018: 37; The Wire 2018).[39]

The term *Science Diplomacy* made its formal debut as a part of India's critical S&T framework lexicon in 2013. India's *Science, Technology and Innovation Policy 2013* — which presently guides the S&T activities in the country — notes that the 'policy framework will enable strategic partnerships and alliances with other nations through both bilateral and multilateral cooperation in science, technology and innovation. Science diplomacy, technology synergy and technology acquisition models will be judiciously deployed based on strategic relationships' (Ministry of Science and Technology, Government of India 2013).

However, India's ongoing tryst with Science Diplomacy would go on beyond a mere mention in a critical policy framework. On 28 October 2014, The World Academy of Sciences (TWAS) announced that it had entered into an agreement with India's Department of Science and Technology to 'embark on an ambitious new programme of science diplomacy training and events both in India and in Trieste, Italy, where TWAS is based.' TWAS noted that India agreed to provide funding for not only its own citizens but also for its partners in the Global South for gaining exposure in Science Diplomacy through TWAS courses held in Trieste, Italy and in India. New Delhi also gained TWAS support in placing scholars from its *INSPIRE* program to research institutions from the Global South (Lempinen 2014).

Furthermore, India's *Research and Information System for Developing Countries* (RIS) based in New Delhi and its National Institute of Advanced Studies (NIAS) based in Bengaluru also initiated a project funded by the country's Department of Science and Technology in the shape of the *Forum for Indian Science Diplomacy* (FISD) on 7 May 2018. The stated objective of FISD is to realize 'the potential of Science Diplomacy by various means, including: Capacity building in science diplomacy; Developing networks and; Science diplomacy for strategic thinking'. FISD further seeks to leverage the strengths of the Indian S&T diaspora to answer India's many challenges in the field of S&T and Science Diplomacy with the RIS already

[39] Beijing's denial of New Delhi's entry to NSG stands in stark contrast to its support for its longstanding ally Pakistan, another non-signatory to the NPT, in the field of nuclear weapons technology. International Institute for Strategic Studies (2007: 25-26) situates China as the 'most important state contributor to the Pakistani nuclear programme' since the 1970s with links to the rouge AQ Khan network leading to possible covert cooperation in key military areas such as enrichment technology, nuclear device-design, missile systems and uranium supply.

having organized training courses in Science Diplomacy under the country's MEA since 2017 — with an emphasis on the ITEC programme meant for participants from India's partners in the Global South (Forum for Indian Science Diplomacy 2019).

India — as a rising power with a large pool of scientists — has a foreign policy in the 21st Century that emphasizes on the role of S&T for developing favorable international cooperation. New Delhi's decision to move towards an S&T agreement with any other state in the international system is guided by the diplomatic value of the agreement; the value of the agreement to India's public interest; and its calculations about its immediate neighborhood and response to global challenges. India further enters international S&T agreements at levels of 'bilateral, multilateral, regional, government-wide or at the level of individual technical agencies' (Sharma and Varshney 2019: 11-12).[40]

India's international S&T engagement is broadly guided by *three areas of consideration* for the country to reach an agreement with a partner in the international system. The first is the preamble applied to justify the motivation for entering into an agreement with a foreign entity; the second are the details which constitute the sharing and exploitation of Intellectual Property Rights; and the third is the manner in which the implementation aspect of S&T diplomacy is to be designed for it to manifest for mutual benefit in practice (Sharma and Varshney 2019: 12).

Sharma and Varshney 2019: (13-17) further inform that the Ministry of Science and Technology, Government of India (GoI) is tasked with the charge of inking, concluding and implementing binding bilateral and multilateral agreements with other entities in the international system in alignment with the Indian MEA and other public or private stakeholders. In accordance with its declared STI 2013 policy, India also seeks access and participation into global S&T projects meant to foster cooperation in the frontier areas of science and innovation — to address issues of global concern such as climate change, natural disasters and health (Sharma and Varshney 2019: 13-17).

[40] Balakrishnan (2017: 292-294) also notes that India's S&T Diplomacy manifests in either the form of bilateral cooperation or multilateral cooperation — with an additional focus on regional cooperation. India has fully functional Science Wings in its diplomatic missions located in countries such as Germany, Russia, Japan and the US. It further has Technical Liaison Officers posted to missions such as the UK, Austria and France.

But there are also issues of clarity of purpose and harmony of actions across organs of the Indian state. Relia, Mitra and Ramasami (2014: 163-164) contend that shared challenges — such as climate change, energy security, food security, health and water security — should figure more prominently in 21st Century India's foreign policy. Relia, Mitra and Ramasami (2014: 163) also assert that 'Technology diplomacy, Technology synergy, and Technology acquisition models may need further elaboration through institutionalized synergy between MOST and MEA.' Balakrishnan (2017: 294-296) posits that — as a state seeking to optimize S&T Diplomacy — India should seek to integrate the interests and objectives of the scientific and the foreign policy communities for achieving greater cooperation of value to its foreign policy objectives.

As per Balakrishnan (2017: 294-296), India can more clearly align its S&T diplomacy to its foreign policy objectives but this has to manifest with greater clarity in terms of planning. This alignment of India's S&T Diplomacy with its foreign policy objectives yet remains to be reviewed, prioritized and updated periodically as a part of an integrated grand strategy. This is partly attributable to the sheer number of public and private sector stakeholders that require coordination for the ideal implementation of a coherent S&T Diplomacy strategy, which is active and alive to the requirements of the country's foreign policy objectives. Balakrishnan (2017: 294-296) contends that If India manages to address these hindrances as a state then it stands to gain through S&T Diplomacy as it builds bridges and ties with other entities in the international system.

These issues are addressed to a certain degree in the country's Draft Science, Technology, and Innovation Policy — in which the Ministry of Science and Technology, Government of India (2020: 47-51) calls for better coordination between the MEA and MOST, and further seeks to shape the international STI system; deploy S&T to serve foreign policy and state interests; and harness international progress in STI for increasing national power and ensuring maximum self-reliance.

In order to develop Science Diplomacy as an effective tool for Indian foreign policy, Relia, Mitra and Ramasami (2014: 163-164) also hold that India needs to put professional Science

Counselors in more states, and prioritize the selection of states and regions to place such human resources. India's career diplomats — per Relia, Mitra and Ramasami — also required a working understanding of the nuances of S&T and Science Diplomacy ideally through the country's Foreign Service Institute or MEA.

Balakrishnan (2017: 294-296) asserts that India — despite its ambitions as a rising power in the 21st Century — still does not have a vast network of specialist Science Officers holding positions in many of its foreign missions. This is despite the country fielding a diplomatic cadre with several of its members originating from a S&T background.

The lack of specialized human resources dedicated exclusively to supporting India's S&T Diplomacy is still apparent in the information provided by Department of Science and Technology, Government of India (2020) — which reveals that India has dedicated Science Wings only in its missions in Berlin, Moscow, Tokyo and Washington, DC. These wings are meant to appraise New Delhi on the latest R&D developments from technologically advanced stations and to facilitate and act to ensure greater S&T engagement between India and their host states. New Delhi further fields specially trained technical liaison officers in its missions in Austria, France, UK and the US to 'interact on behalf of Indian interests in the fields of S&T' according to the Department of Science and Technology, Government of India (2020).

As per Parthasarathi (2018: 1601), India's human resources posted abroad and meant for provision of input in the domain of S&T Diplomacy overwhelmingly come from the country's elite universities — such as the Indian Institutions of Technology (IITs) — instead of its major Research and Development (R&D) bodies such as ISRO or DRDO. Hailing from a pure S&T background, the new recruits lack the bureaucratic know-how and the ability to work with personnel from different backgrounds, including those in the Indian Foreign Service.

Parthasarathi (2018: 1601-1602) scrutinizes the charter of duties that has been assigned to India's S&T Counselors abroad. According to research conducted by Parthasarathi, India's S&T Counselors have a vague and poorly-defined mandate, with just an emphasis on 'improving S&T relations with the country of their accreditation'. That diplomacy also has an 'offensive' component meant to serve the national interest — such as India's competition with China and Pakistan in the realm of S&T Diplomacy — may be something that many

Indian S&T Counselors posted abroad might not yet be in a position to fully comprehend and appreciate. India may also be placing more emphasis on the component of science than the component of technology in its S&T Diplomacy. As per Parthasarathi, India's S&T Counselors lack the capacity to competently act as India's S&T Diplomats (Parthasarathi 2018: 1601-1602). Balakrishnan (2017: 294-296) posits that India requires its diplomatic corps to have some background in S&T, so that the gap in terms of specialized science officers posted abroad is plugged to a workable extent.

Parthasarathi (2018: 1601) further scrutinizes the training that goes into the making of an Indian Science Counselor by pointing out that the orientation programs devised by the country's DST lack content that enables scientists to competently address areas such as Intellectual Property Rights (IPRs) and even the basics of the overall S&T environment in India. The country's Science Counselors also lack fieldwork experience essential to their position abroad — such as even having visited India's flagship industrial projects such as Bharat Heavy Electricals Limited (BHEL) or Bharat Electronics Limited (BEL).

This gap is addressed by the Ministry of Science and Technology, Government of India (2020: 51) in its Draft Science, Technology, and Innovation Policy by declaring that: 'The number of S&T Counsellors will be increased and rationality behind having an S&T counsellor in a specific country will be reviewed periodically. The role of S&T Counsellors will be revitalised and redefined given evolving technologies, nature of national demands and changing global dynamics. S&T Counsellors will be empowered to create opportunities for greater participation of the Indian scientific community, both in India and abroad.'

Also, the condition of posting a small but specialized staff in missions abroad to serve S&T Diplomacy objectives is hardly unique to India. Ruffini (2017: 70-71) states that the number of Russian Science Counselors posted abroad — appointed and managed curiously by the country's Ministry of Higher Education — remained at only 15 in 2015 and further had a representation from the Ministry of Foreign Affairs and Ministry of Research with impeccable academic credentials not necessarily being the criteria for the position. Russia's international S&T engagement — per Ruffini — was also marked with presence of officials from other departments, such as economics, working in the field without necessarily

specializing in it. Furthermore, in terms of stations even the EU fielded Scientific Counselors only in Brazil, the US, Ethiopia, Japan and Russia by 2017 as per Ruffini (2017: 70-71).

However, India's Asian rival China — according to research conducted by Ruffini (2017: 69-70) — had built an extensive scientific network of 141 trained personnel based in 69 missions across 46 states to further its international S&T interests by 2012. Chinese personnel placed abroad for activities that fall under S&T Diplomacy also originate predominantly from the country's Ministry of Science and Technology, with a background in both S&T and foreign language skills.

Balakrishnan (2019) situates India's efforts to secure a position as a legitimate, responsible and globally recognized nuclear weapons power in the 21st Century as a success of the country's Science Diplomacy. Balakrishnan notes that India is not a signatory to the Non-Proliferation Treaty (NPT) and had to suffer a prolonged era of western sanctions in the realm of nuclear technology after having pursued its nuclear weapons program. However, since 2005, India not only managed to enter into bilateral nuclear agreements with the US and other states but also secured legitimacy from the International Atomic Energy Agency (IAEA) and the NSG — a condition that enables it to resume 'normal nuclear commerce' in the international system. Balakrishnan attributes India's rise as a *de facto* nuclear power in the view of the global nuclear regime as an effort that required the energies of both its scientists and diplomats.

While Balakrishnan (2019) notes India as having launched a landmark initiative in terms of the use of renewable energy to address climate change along with France in the form of the *International Solar Alliance* (ISA), he also notes that the dependency of the country on fossil fuel in light of a need for steady economic growth. In this regard, Balakrishnan contends that 'both technology and finance are critical for India and other developing countries to move into a low carbon pathway.'

Balakrishnan (2019) situates India in the 21st Century as having made considerable progress in terms of ICT but also cautions that the rise of new and disruptive technologies as an outcome of unprecedented advances in the field create global issues that the country will have to address through Science Diplomacy. Balakrishnan notes that India will have to

address challenges in biotechnology and oceanic sciences — particularly in the Bay of Bengal and the Arabian Sea regions — through deft Science Diplomacy. Balakrishnan (2019) further notes that the militarization of space with the advent of Anti-Satellite Technology (ASAT); the accumulation of space debris around Earth; and the question of rights to extraterrestrial bodies are areas in which India will seek to address growing challenges in the 21st Century through Science Diplomacy.

India's incumbent Foreign Secretary Harsh Vardhan Shringla (2020b: 6) situated the COID-19 pandemic as the 'greatest shock to the international system since the Second World War' and noted that the pandemic had posed pressing challenges in terms of economy, geopolitics and societal issues. Shringla (2020b: 9) also noted India's response to addressing the COVID-19 pandemic as a global issue through its supply of life-saving medicine such as Hydroxychloroquine (HCQ) and Paracetamol to its partners across the world, amounting to more than a 150 sovereign states in the international system. Shringla (2020b: 9) further noted the rapid deployment of Indian medical professionals abroad, and supply of critical healthcare components outside of India as evidence of India having emerged as a first responder and a net provider of health security.

With the emergence of credible vaccines to answer the ongoing COVID-19 challenge, it was India — through its international *Vaccine Maitri* (Friendship through Vaccines) campaign — that sought to fortify human beings, living in states encompassing its partners in the international system as large as Canada and Brazil and as small as Barbados and the Dominican Republic, with immunity against a novel coronavirus. India's vaccine diplomacy also came at a time when the US was occupied with its own domestic issues under a chaotic Donald Trump administration and China's health diplomacy came with its own untenable conditions attached (Pant and Saxena 2021). Sharma (2020: 19-20) notes that states such as India had to grapple with domestic challenges during the ongoing COVID-19 pandemic but also asserts that both the US and EU — two of the most affluent political entities in the international system — failed to give rise to a joint and coherent response to the COVID-19 challenge due to political differences and variations in priorities.

Chapter Summary

Having pursued existing literature in *all* of the sections above for gaining theoretical insight — it becomes clear that whilst theorists of S&T Diplomacy might have been divided in delivering their eminent postulates on the subject along idealist and realist lines, the Indian state as an entity in the international system has perpetually sought to pursue its own unique version of S&T Diplomacy, which functionally falls closer to the realist line — despite the country's rhetorical advocacy for the Global South and pacifist proclamations — since the country's independence from the British Empire in 1947.

The country's foreign policy in the 21st Century has showed a marked departure from policies created at time of weaker state power during the previous century — which were made in face of a much more adverse international system — towards a more ambitious diplomatic agenda in conjunction with its strategic partners to enable its rise through S&T, despite existing internal limitations that are addressed in the subsequent chapters of this study.

Rising India of the present-day has further emerged as a significant responder to global issues impacting the international system such as the ongoing COVID-19 pandemic — and this is in addition to a long history of the country having utilized other windows of opportunity to deploy its S&T assets and capabilities to address its foreign policy objectives and state interests. These are discussed in greater detail in the subsequent chapters of this thesis.

Chapter 3: Science & Technology Diplomacy and India's Development Cooperation in the 21st Century

This chapter explores core calculations made by India to deploy the S&T component of the country's longstanding development cooperation strategy in the 21st Century international system. The chapter begins by charting the evolution of India's development cooperation programme *itself*, and goes on to examine India's own unique design for ensuring international S&T cooperation for national progress within its geographical confines; the logic of S&T Diplomacy given India's outbound development cooperation for advancing vital foreign policy interests; and India's S&T-enabled development cooperation strategy meant to answer the demands of the international system in accordance with the country's state interests. The chapter also explores details of S&T-based development cooperation and domestic dynamics in the Indian environment.[41]

Evolution of India's Development Cooperation Programme

India's emphasis on utilizing S&T as a core component of its development cooperation programme has roots in the history of the country's diplomacy. The Indian development cooperation programme itself has origins in the country's early foreign policy objectives of emerging as a leader of the newly decolonized world, and engaging with its counterparts from the Global South under of the principles of non-interference and non-alignment. Early Indian foreign policymakers sought to portray the country as one which understood the pains of colonization and meant to help its partners in the developing world in their development and modernization efforts. The two founding influences on the Indian development cooperation programme were the *Colombo Plan* of 1950 — which focused on economic development and technology sharing without any controversial political and social

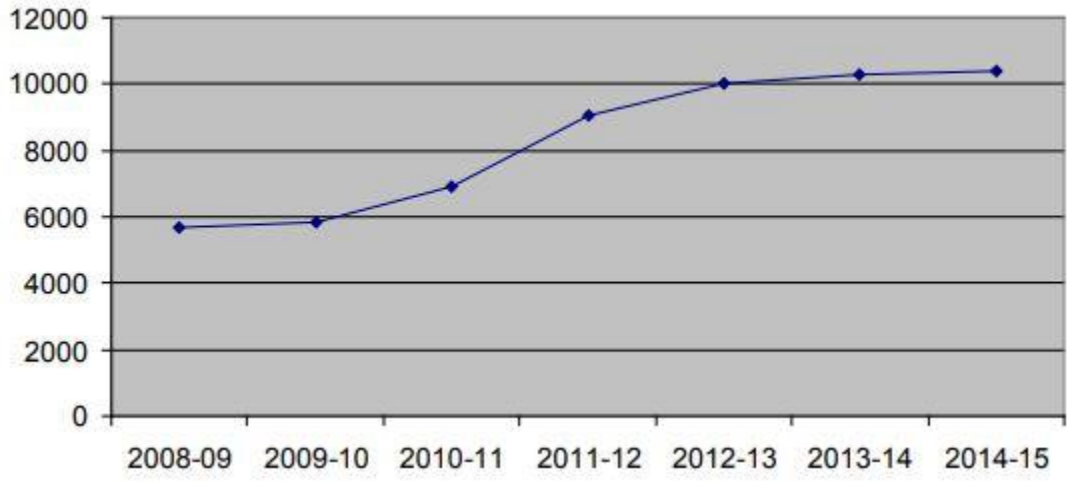
[41] Balakrishnan (2017: 292-294); Sharma and Varshney (2019: 11-12); Ministry of Science and Technology, Government of India (2013); Department of Science and Technology, Government of India (2019b); Swaraj (2019); and the Ministry of Science and Technology, Government of India (2020: 47-51) inform the building of the categories for this chapter.

clauses — and the *Five Principles of Peaceful Coexistence*, or *Panchsheel*, signed between New Delhi and Beijing in 1954. The Colombo Plan carried the initial template for technical cooperation and exchange of development experiences between developing states which would lead to the notion of South-South Cooperation enduring in India's foreign policy calculation even after its rise in the 21st Century. The core postulates of Panchsheel — which were non-interference and mutual respect for territorial integrity and sovereignty — also endured the Sino-Indian Border War of 1962 and became ingrained in India's outbound development cooperation programme (Mullen 2013: 3-5).

India's commitment to rapid economic development of all states under the helm of its first Prime Minister Jawaharlal Nehru stemmed from not only internationalism but its own experience as a newly-independent country facing skill shortages despite an objective to realize rapid national development. By the 1950s, India had gained experience in skill development by engaging with multilateral initiatives such as the Colombo Plan and the Special Commonwealth Assistance for Africa Programme (SCAAP). Also owing to its own experience of benefiting from its institutions such as the Indian Institutes of Technology (IITs), India initiated a series of human resource development programs focused on technology and thus the Economic and Coordination Division was set up within the country's MEA in 1961, which would later pave way for its flagship Indian Technical and Economic Cooperation (ITEC) programme. India had also established an Indian Aid Mission (IAM) in Nepal in 1954 with an intention to oversee its development cooperation projects in its Himalayan neighbor but would rename it as the Indian Cooperation Mission (ICM) in 1966 with an added intention to convey the message that the country's development cooperation went further than simply the mere provision of aid (Chaturvedi 2012: 559-561).

India's development cooperation with its counterparts in the international system in the field of education would also continue well after the initial years of its independence. In 1967, the country's Education Minister Triguna Sen, on the floor of the lower house of Indian parliament, remarked that over 4500 students from over 50 countries studied in India by 1967. Sen further noted that the Government of India covered tuition fees, study expenses and costs of living for many of these students who not only hailed from developing countries

but also from developed states such as Australia, Belgium, Canada, France, Japan, New Zealand, the UK, USSR and US (Press Information Bureau, Government of India, 1967).



Rise of the ITEC programme in terms of capacity building slots offered by the GoI between 2008-09 and 2014-15, as per the Ministry of External Affairs, Government of India (2014).

India's primary S&T component in service of its diplomacy as a part of its development cooperation programme came in the form of the ITEC programme in 1964, which was overseen by the country's MEA as its flagship initiative for providing technical assistance on a global scale. ITEC was guided by the notion that developing states were also in a position to provide development cooperation to their counterparts in the international system just like the developed states, and further came with no overt conditions attached — unlike technical assistance originating from much of the developed world. The ITEC programme — which was fully funded by India since its inception — took a non-interventionist approach and sought to answer to the demands of the recipient state. India went on to provide substantial capacity building through ITEC and SCAAP to its partners in the international system by training personnel from abroad; undertaking feasibility and consultancy services for development projects abroad; dispatching its experts abroad to aid in development cooperation and inviting foreign aspirants to conduct research in India; allocation of technical equipment for development projects; and aiding in disaster management and

containment. The ITEC programme was initiated to solidify India's leadership in the Global South and has helped forge closer ties with the developing members of the international community by training of bureaucrats, technocrats and skilled workers from over 158 countries in a cost-effective and efficient manner (Mullen 2013: 5-7).

The ITEC programme lent early assistance to not only South Asian states but also to African states such as Ghana, Uganda and Nigeria. By the 1970s Indian organizations such as the National Industrial Development Cooperation (NIDC) were further carrying out technical and economic surveys on the behest of India's partners in the developing world such as Iran, Afghanistan, Yemen and Fiji (Chaturvedi 2012: 563).

On 23 April1973 — in a debate on budget demands held at the floor of the Indian Lok Sabha — the then incumbent Minister of State (External Affairs), Surendra Pal Singh stated that the international system had begun to display signs of emerging multipolarity, eroding the prevailing bipolar system. Singh justified India's adherence to the principle of non-alignment as being in the country's national interest. Singh further stated that — due to the GoI's efforts — India had begun to emerge as a leading provider of technological information, training and expertise which had devoted a special attention to multilateral forums such as the Colombo Plan and SCAAP. According to Singh, India's S&T engagement such as the ITEC programme and deputation of experts to address challenges faced by its partners in the developing world had elevated the country's reputation in the international system (Singh 1973: 38-42).

In terms of a declaration of intent from the viewpoint of a serving functionary of the state — Singh noted that 'In spite of our difficulties at home, despite our own limitations, we have done everything possible to share our experience, our resources, with a large number of countries, and we have done everything possible to help them in their very difficult task of economic and industrial development. I must say that this approach to our foreign policy has already paid some very handsome dividends in as much as it has greatly increased the goodwill, friendship and trade between ourselves and a large number of countries in Africa and Asia' (Singh 1973: 41).

Singh noted that India's 'greatest activity' in the area of economic cooperation was in Africa — since the South Asian giant was in an optimum position to assist the development of states in the continent owing to shared challenges emanating from a post-colonial history. Singh noted that India had provided grants to candidates from African states for training in India. Singh also noted the provision of Indian technicians, educators and medical staff to Africa as well as a growing amount of joint ventures between Indian and African entrepreneurs in areas such as pharmaceuticals and chemicals (Singh 1973: 41-42).

By 1993, the ITEC programme had emerged as a pillar of India's South-South cooperation strategy and — as an initiative funded entirely by the GoI — had trained over 20 thousand foreign candidates as a part of India's capacity building initiative. In 1993, over 4 dozen Indian experts also assisted India's partners from the Global South in their national development efforts. India's ongoing ITEC projects abroad in 1993 included establishment of valuable development cooperation assets such as: a Remote Sensing Centre in Nigeria; a Vocational Training Centre in Mongolia; a Multi-Purpose Small Industries Training Centre in Vietnam; and a Solar Photovoltaic plant in Oman. As a part of its ITEC outreach, India managed to establish closer cooperation with over 100 states in 1993, including those from the erstwhile Soviet Union and in Eastern Europe (Dixit 1993: 263-265). In his address on ITEC Day, 15 September1993 — India's foreign secretary Jyotindra Nath Dixit (pp. 263-265) stated that 'The ITEC programme is now nearly 3 decades old. Over this period, it has helped in fostering commonality of outlook and interdependence between India and partner countries of the South - in the economic and commercial fields, particularly in tackling the various problems of development and nation building, in the South. What is more, the programme has helped in building bridges of understanding and friendship between India and these countries'.

India's development cooperation initiatives found new strength in terms of economic capability that accompanied India's rise in the 21st Century. Following an increase in national confidence after the 1998 nuclear tests, India's development cooperation policy became more aligned with its status as a rising power. Indian policymakers — in light of the country's steadily building foreign exchange reserves; rising foreign direct investments; and steady economic growth rates — sought to revise India's status as a traditional net acceptor

of aid by setting the ceiling for inbound aid to 25 million USD during the early 2000s, limiting the providers of aid to India to the roughly the Group of Seven (G-7) countries in terms of bilateral cooperation. Despite the country's rising profile — Indian policymakers have also been cautious to avoid the term donor and have consistently opted for the less-intrusive term development partner instead (Chaturvedi 2012: 557-559).

By 2003, India had embarked upon a course to lessen its dependence of external donors and emerge as a reliable donor in its own right for other states seeking development cooperation and assistance in their own national interest (Saxena 2016: 2-3). In his *Budget 2003-2004* speech delivered on the floor of the Indian parliament in New Delhi on 28 February2003 — veteran Indian politician and the then incumbent Minister of Finance and Company Affairs — Jaswant Singh declared the government's intentions of reviewing India's dependence on external donors. Singh (2003: 21-22) expressed his gratitude to India's development partners for their past efforts in contributing to the country's national development. However, Singh also stated that the country in 2003 sought much smaller assistance packages with a preference of external financial resources being allocated to Non-Governmental Organizations (NGOs) — instead of the GoI — for meeting specific challenges. Singh (2003: 21-22) stated that the Government of India did not intend to take any 'tied aid' from its foreign partners but would allow existing inbound development cooperation projects to continue until their agreed completion.

Singh (2003: 11-12) also remarked that the GoI sought to take advantage of India's rising foreign exchange reserves and modest domestic interest rates to embark upon early repayment of 'high-cost' loans secured from multilateral forums such as the World Bank and the Asian Development Bank — which totaled a combined figure of approximately 3 billion USD. Finance Minister Singh articulated that it was India's intention to expedite repayment of the 'higher cost component' of its external debt profile to effectively manage its external liabilities.

New Delhi's first actual declaration of intention for providing financial relief to its Heavily Indebted Poor Countries (HIPCs) partners in the international system was further originally articulated by Singh (2003: 22) — who first proposed the short-lived India Development Initiative (IDI) for providing economic and technical assistance to the country's partners in

the Global South. Following the budget speech by Indian Finance Minister Jaswant Singh in 2003, the GoI launched the IDI, which enabled the country's Export-Import (EXIM) Bank to extend Lines of Credit (LoCs) to states which had entered into a mutual agreement for development cooperation with India (Saxena 2016: 3-4).

By 2003, the country had advanced Government-to-Government finances to 23 states through its now-established LoCs in USD, GBP and INR. For disbursement of funds through the State Bank of India, the Indian government entered into a credit agreement with the recipient state, and then extended aid through its LoC mechanism, which directly disbursed the loan amount through a currency depending upon the agreement (Saxena 2016: 2).

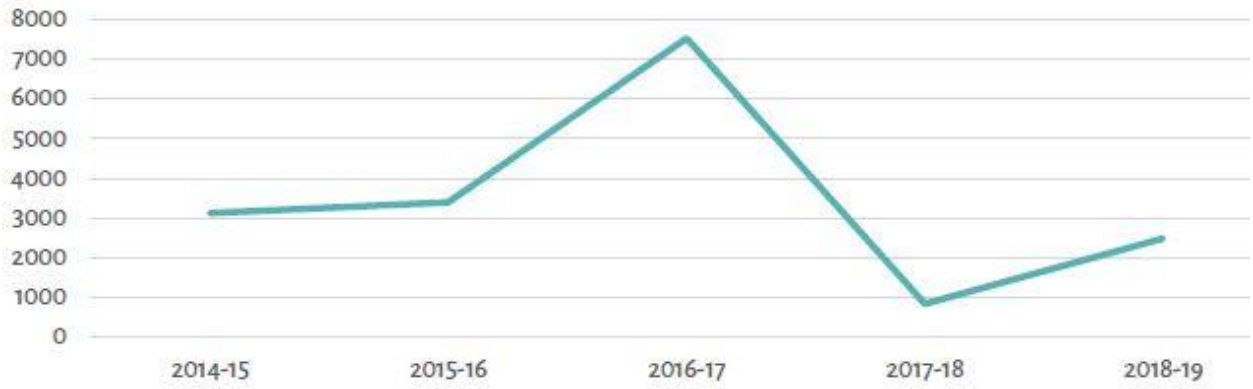
By July 2005, India had renamed its development cooperation programme as the Indian Development and Economic Assistance Scheme (IDEAS) — with an objective to enhance exports, reach new markets, and cement the rising power's reputation as a provider of quality goods and services. India also sought to gain political influence and goodwill with its partners in the international system through IDEAS. IDEAS was originally proposed for five years since its inception in FY 2005-2006 but — given consistent extensions — has been extended to at least 2020 via a GoI approval on 18 November 2015 under the first Narendra Modi administration (Saxena 2016: 3-4).

In 2007, India's then incumbent Finance Minister P. Chidambaram — in his address to the Indian parliament on the occasion of announcing the government's budget — remarked that 'In keeping with India's growing stature in international affairs, we must willingly assume greater responsibility in promoting development in other developing countries. At present, India extends development cooperation through a number of Ministries and agencies and the total sum is about US$ 1 billion per annum. It is felt that all activities relating to development cooperation should be brought under one umbrella. Accordingly, Government proposes to establish the India International Development Cooperation Agency (IIDCA). The Ministries of External Affairs, Finance and Commerce and other stakeholders will be represented on IIDCA' (Chidambaram 2007).

India's outbound development cooperation programme would gain greater encouragement from the country’s establishment with the rise of the IIDCA — with its ideational origins in

2003-04 but its formal commencement in 2007. The IIDCA would be guided by the principle that the countries that most required India's outbound development cooperation would be those that were in greater need for inbound international assistance than India itself. The IIDCA also sought to build upon the workings of its precursor, the IDI (Chaturvedi 2012: 564-565).

In 2012, the IIDCA was further announced as being restructured to the Development Partnership Administration (DPA) within the Indian MEA, with a division aiming to connect other divisions dealing with aspects such as project feasibility and financing. In the second decade of the 21st Century, three key instruments of Indian developments assistance came to fore: Lines of Credit (LoC), grant-based assistance and the ITEC programme. In addition, 21st Century India increasingly granted favorable market access to states from the Least Developed Countries segment in the international system and from states within its South Asia region — such as Bangladesh — to aid in their national progress and development (Chaturvedi 2012: 563-566).



Exim bank Lines of Credits in USD million sanctioned under the first Narendra Modi administration (Mullen 2019: 9).

Currently, India's outbound development cooperation comprises of a *Development Compact* model comprising of five components — which according to Saxena (2016: 1) are — 'capacity-building and skills transfer, technology and related partnerships, development

finance (which includes concessional loans and lines of credit), grants, and trade and investment (which also includes duty free quota free, DFQF scheme).'

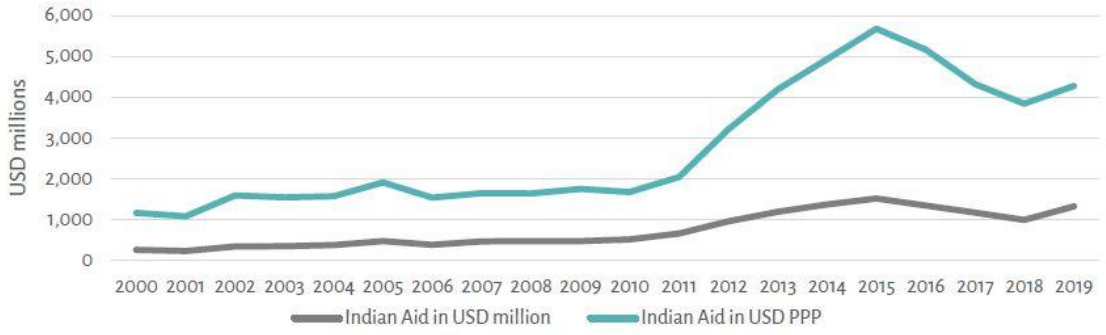
In 2016, Shashi Tharoor — former Under Secretary General of the United Nations for Communications and Public Information, and former Indian Minister of State for External Affairs — noted that the emergence of India as a donor state in the international system with the second largest external aid budget from the Global South, next only to China, is a fact that is under-appreciated in international relations. Tharoor (2016) noted that India as a rising power was increasingly aware of engaging in its self-interest with other states in the international system, and the country's rising economic clout meant that states that sought external support for their development had begun to increasingly look towards the South Asian giant for assistance.

Noting India's rise, Tharoor (2016) states that: 'After decades of being portrayed as a poor and backward nation, India’s transformation into a global force on the back of its economic triumphs and its technological prowess is a new fact of life.' Tharoor further conceptualized that India's economic growth and its ability to manage its internal issues had given legitimacy to the notion of India's rise — with the country now in a position to shape the international system outside of its region of South Asia. Tharoor (2016) noted that India's era of aid-dependency was behind it in the 21st Century, and its external policies formulated at a time when the country's national power was limited needed to be re-visited.

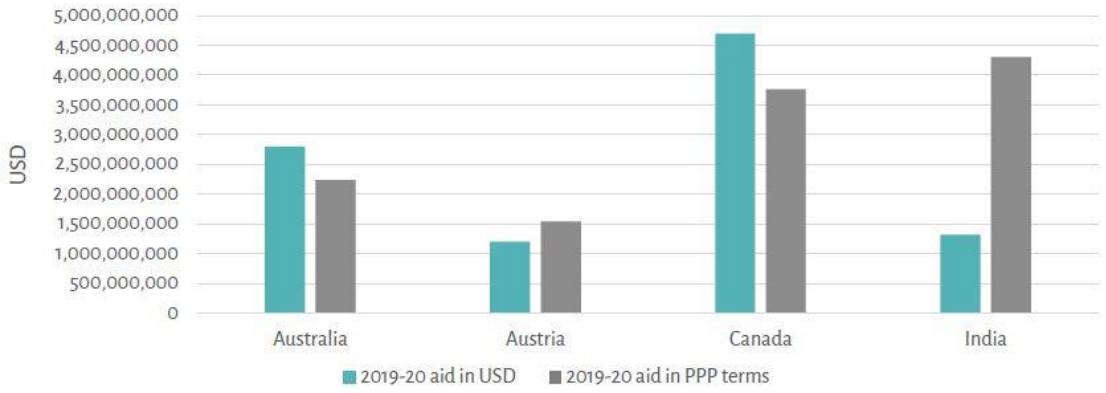
Tharoor (2016) situates India's aid to the Global South as being tied into goods and services from suppliers from India — and being less disruptive and intrusive in comparison to the traditional donors in the international system. Per Tharoor (2016), India allows greater freedom for the recipients of its aid to set priorities for achieving self-reliance and economic growth.

Tharoor (2016) notes the increased financial wherewithal in 21st Century India's development cooperation programme — manifesting in milestones such as the pledge for 10 billion USD in Line of Credit (LoC) for development projects in African states during the 2015 India-Africa Summit held in New Delhi. Tharoor also notes the prevalence of the S&T component in India's development cooperation programme by noting the prominent role of

the ITEC programme — and the country's capacity building initiatives in the fields of health, infrastructure, ICT and education. Tharoor (2016) concludes by remarking that 'being a credible aid donor' is 'one of the best consequences of India's emergence as a global economic power.'



India's foreign assistance commitments in pure USD terms vs. actual USD Purchasing Power Parity (PPP) — as found by Mullen (2019: 10).



India's 2019-20 foreign assistance compared in USD and PPP terms with Australia, Austria and Canada — as per Mullen (2019: 10).

In 2019-20, India had committed USD 1.32 billion in grants, loans and subsidies to its partners in the international system — and had further placed forth LoC plans worth USD 2 billion as part of its outbound development cooperation programme, surpassing developed

states such as Austria in foreign assistance in terms of net value in USD. But the real strength of the Indian development cooperation programme's budget might lie in its Purchasing Power Parity (PPP), which allows the South Asian giant to provide and deliver a far larger amount of goods and services per dollar than many of its more affluent counterparts in the international system — given that the bulk of goods and services tied to New Delhi's foreign assistance are mostly sourced from India itself, where a USD has a far greater amount of purchasing power in comparison to many developed states. In the context of PPP, India's foreign development cooperation in actual terms might outweigh such established development providers in the international system as Australia, Austria and Canada (Mullen 2019: 9-10).[42]

S&T Diplomacy, Development Cooperation and India's National Progress

Since Independence, India has had a policy to seek S&T for its own national development and rise without being drawn into existing inter-state rivalries. India's quest for seeking cooperation and assistance for national development came at a time when the international system was marked with US-USSR rivalry, and the country sought to navigate through the polarized waters by adopting a declared policy of non-alignment (Nehru 1959: 2-3; Nanda 2004: 51-52).[43] The US until the mid-1970s enabled India's scientists in training across a

[42] Prasad (2011: 16) also notes that India's development projects in Afghanistan tend to provide optimum delivery while also being remarkably cost-efficient, and asserts that 'Indian projects in Afghanistan, with purchasing power parity allowing for lower materials and consultancy costs, show much more *bang for the buck*.'

[43] Lele (2019b) cautions that India during the 20th Century 'may not have thought in a bookish fashion to use science and technology as an instrument of diplomacy'. But importantly, during the same period, India's diplomacy also embarked on seeking international S&T assistance or collaboration for national development, which made S&T a practical part of the country's diplomacy and foreign policy. Lele (2019b) situates independent India under its first Jawaharlal Nehru administration as having focused on S&T for national objectives such as poverty eradication. Lele (2019b) notes that several key scientists in India benefited from training abroad and later returned to the country to frame its own policies. Selvamurthy (2019b) also notes that India sought to train its human resources in the field of S&T abroad and benefited from diverse sources such as the US, UK and Russia. According to Selvamurthy (2019b), India in the 20th Century sought to access global technology and apply relevant outcomes to give rise to its own breakthroughs such as *Green Revolution* and *White Revolution* to address its national development issues.

broad range of S&T for its national needs, and provided the country with a short-lived food aid program. However, Washington, DC resented India's sympathies towards Moscow and also supported Pakistan — India's perceived rival in South Asia — in its efforts to balance New Delhi in the region (Nanda 2004: 55-57).

Through much of the Cold War, Washington's assistance to New Delhi came with realist expectations attached — which were often inimical to India's national interests. On 28 October 1974, Lieutenant General Brent Scowcroft — the US Deputy Assistant to the President for National Security Affairs — met India's PM Indira Gandhi, EAM Yashwantrao Balwantrao Chavan and other senior members of the Indian establishment. Scowcroft (1974) stated he told PM Gandhi that the US saw the 1974 Indian nuclear test as 'a bomb no matter how India described it; that her undertaking not to produce nuclear weapons did not mean the next government would not do so; and that we were not interested in recriminations but in how to prevent further proliferation.' Scowcroft (1974) observed that the Indian EAM Yashwantrao Chavan had given an indication to not develop the country's nuclear weapons any further and that Chavan was sensitive to an 'aid complex' exerting an undue influence on Indo-US bilateral relationship while simultaneously seeking economic and food aid from the US under its PL 480 program.

Strong retaliation from the US and its allies after India’s first nuclear tests in 1974 would continue. Even though Canada assisted India in the initial development of its nuclear programme, it joined the US and other western powers in sanctioning nuclear supplies to India after the country's first nuclear explosion in 1974 (Nanda 2004: 55-57). Mallik (2016: 77) stresses 'that the NSG was formed specifically to target India for its 1974 nuclear experiment'. Lele (2019b) notes that, following its 1974 nuclear tests, India faced 'technological apartheid' from major powers in the international system. Lele also notes that many of these sanctions spurred indigenous technology development in areas such as nuclear and space technologies (Lele 2019b).

By this time, New Delhi had signed the *Treaty of Peace, Friendship and Cooperation* with Moscow on 9 August 1971 that also included Articles VI-VII — meant for developing further ties in the field of S&T (Government of India and the Government of The Union of Soviet Socialist Republics 1971). It was from the USSR that foreign assistance to India for

developing the country's most valued and advanced technological assets — in the field of heavy machinery, pharmaceuticals, hydro-technology, oil & gas, metallurgy, electrical engineering, mining, space and power — most notably arrived during the Cold War. Socialist states of Europe such as Poland and Czechoslovakia also served as sources for India's industrial requirements during the same period (Nanda 2004: 54-57).

In 1993 — following the downfall of the Soviet Union — New Delhi sought to continue S&T cooperation with Moscow, which was its primary source of technology for national development during the Cold War. The 1993 Indo-Russian Agreement in the Field of Science and Technology allowed for the reorganization of: *The Indo-Soviet Sub-commission on Science and Technology Cooperation* to *The Indo- Russian Sub-commission on Science and Technology Cooperation*; and *The Indo-Soviet Joint Council on Coordination and Implementation of the Integrated Long Term Programme of Cooperation in Science and Technology* to *The Indo-Russian Joint Council on Coordination and Implementation of the Integrated Long-Term Programme of Cooperation in Science and Technology*. Through the agreement, New Delhi and Moscow sought continuity in S&T coordination with a clear emphasis on future cooperation (Government of India and the Government of the Russian Federation 1993: 23).

However, the desire to build bridges with the US in the post Cold War era was also felt in New Delhi and this led to advances such as Phanindranath Rangarajan (PR) Kumaramangalam — India's Minister of State for Science and Technology — visiting the Silicon Valley in the San Francisco Bay Area between 17-21 April 1993. During his address to a conference at the IT firm Silicon Graphics, Kumaramangalam emphasized upon the country's ongoing economic reforms and ensuing willingness to integrate itself into the global economy in the presence of nearly five dozen senior members of the American ICT sector in a bid to attract greater foreign investment from the US. The Indian minister also interacted with the country's diaspora from the Silicon Valley with an intention to seek greater engagement of the diaspora with a liberalized Indian economy (Press Information Bureau, Government of India 1993: 108).[44]

[44] India had not departed significantly from its earlier position of advocating for development in the Global South to the developed world even during the closing years of the 20th Century. India's Union Minister for Urban Development and Poverty Alleviation Jagmohan Malhotra — in an address to the *Joint India-EU Seminar on Cities*

For much of the 20th Century, the US saw India as a weak power that held on to some or the other variant of non-alignment in its foreign policy calculations — and thus not an ideal state for investing political capital despite both countries sharing democratic values. Strategic convergence steering the two states to enhanced cooperation arrived in the 21st Century given India's rise with both powers seeking to address common challenges such as international terrorism, maritime security and China's rise (Saran 2017: 192-194).

In January 2004, the two countries agreed to take steps to enhance bilateral cooperation in three critical areas of civilian nuclear activities, civilian space programs, and high-technology trade — and to further expand dialogue on missile defence. This Indo-US *Next Steps in Strategic Partnership* (NSSP) initiative was designed on the principles of reciprocity, mutual interests, and regional and global security. On 17 September 2004, Joseph Adam Ereli — the Deputy Spokesman of the US Department of State — released the *United States - India Joint Statement on Next Steps in Strategic Partnership* to the global press in which both countries announced progress made as part of the first phase of the ambitious initiative — which included the removal of Indian Space Research Organisation (ISRO) from the US Department of Commerce Entity List and further empowered the US to modify its export licensing policies in accordance with its laws, paving way for cooperation in high-value areas such as commercial space sector and civilian nuclear energy (Ereli 2004).

The NSSP resulted in the opening of strategic technological cooperation between India and the US — and both sides further declared their will to embark upon a civilian nuclear agreement on 18 July 2005, marking a transformation in the relationship despite initial domestic controversy in both countries. The Indo-US nuclear agreement gained Congressional approval in the US on 1 October 2008, ending an era of US-led nuclear sanctions on India that had lasted for decades. The Indo-US nuclear deal became even more

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of Tomorrow held in New Delhi in October 2000 — stated that cities in the Global North tended to be sparsely populated, more affluent, technologically advanced and highly consumerist while citizens from cities in the Global South faced appalling living conditions. Given that the upcoming century would be that of urban civilization, Malhotra contended that states in the developing world — including India — were faced with pressing development issues while their counterparts in the developed world enjoyed a high standard of living, creating unsustainable levels of global disparity. Malhotra also noted the futility of previous international conferences and commissions in meaningfully addressing the issues of the Global South and called for greater understanding from the developed world to the needs and sensitivities of the developing world to reach a harmonious international system (Press Information Bureau, Government of India 2000).

significant because, at the time it took effect, India was yet to sign the Nuclear Non-Proliferation Treaty (NPT) despite its impeccable non-proliferation credentials — making it a singular case in which Washington, DC was willing to share sensitive nuclear technology with another state which it had sanctioned before (Saran 2017: 192-198; Bajoria and Pan 2010).

Since the emergence of a Rising India's strategic partnership with the US — Washington, DC has emerged as a key source for New Delhi's efforts towards securing its national objectives. Both sides signed the *Communications Compatibility and Security Agreement* (COMCASA) agreement in September 2018 — enabling India to have greater access to and compatibility with US defence technology. The two sides also maintain a *Defence Procurement and Production Group (DPPG)*, a *Senior Technology Security Group* (STSG), a *Joint Technical Group* (JTG) and further support the *Defence Trade and Technology Initiative* (DTTI) to enhance the level of the ongoing bilateral defence cooperation. Both sides also cooperate in cyber-security and the application of technology in domestic security.[45] Since 2016, India is also recognized as a *Major Defence Partner* of the US — a USG designation meant to prioritize the country in its global security calculations, with defence trade and technology ties being elevated at nearly the same levels as treaty allies. On 30 July 2018, US Commerce Secretary Wilbur Ross further elevated India to Tier-1 of the US Department of Commerce's Strategic Trade Authorisation license exception through an official announcement (Embassy of India, Washington, DC, USA 2020).

The two sides maintain a *Strategic Energy Partnership* and have been seeking to place Westinghouse nuclear reactors in India's Kovvada Atomic Power Project. Both sides also cooperate in natural resource management including exchanges on oceans, mining, marine pollution and biodiversity — in accordance with India's commitment to blue economy. S&T cooperation is further realized through mechanisms such as the *U.S.-India Science and*

[45] India signed a comprehensive cyber security agreement with the US in 2011 and later agreed to increased information sharing and cooperation during the National Security Advisers meeting in June 2013. The Third Indo-US Strategic Dialogue in June 2012 also addressed cyberspace by formulation of a Joint Working Group for cooperation on cyber security. By September 2013, India's Computer Emergency Response Team (CERT-In) and the United States Computer Emergency Readiness Team (US-CERT) were carrying out joint drills by testing each other's cyber infrastructure in a controlled environment to identify gaps in each other's cyber security environment. India has enjoyed a robust cyber security relationship with the US since then (Mallik 2016: 166-175).

Technology Endowment Fund — resulting in joint research in critical areas such as health, environment and agriculture (Embassy of India, Washington, DC, USA 2020; Juster 2018).

21st Century India also relies on its other strategic partners for securing technology to deliver to its national needs. Since the inception of full diplomatic relations with Israel on 29 January 1992, Indian leaders have sought Israeli expertise for addressing their water management and agriculture requirements. The two countries reached an *Agreement for Cooperation in the Field of Agriculture* as early as 24 December 1993 and have made several agreements in the field of agriculture since then. The landmark 2003 state visit of Israeli PM Ariel Sharon to India in September 2003 also saw Minister of Agriculture Israel Katz accompany his head of government to New Delhi. In November 2005, India sent Sharad Pawar — then Minister for Agriculture, Consumer Affairs, Food and Public Distribution — to a state visit to Tel Aviv to mark the tenth death anniversary of Israeli PM Yitzhak Rabin, an opportunity used also to exchange ideas related to bilateral cooperation in agriculture and water management. Pawar would visit Israel again in May 2006 with an eminent Indian delegation comprising of Chief Ministers of Indian states of Rajasthan, Gujarat and Nagaland to sign a *Three Year Work Plan for Cooperation in the Field of Agriculture* (Embassy of Israel in India 2020a).

More concrete progress would come with the visit of Israeli Minister of Agriculture Orit Noked to India in May 2011, which led to the two sides forming a Joint Working Group (JWG) to give rise to a bilateral agricultural action plan for the coming three years and agreeing to further joint agricultural R&D (Embassy of Israel in India 2020a). By 2020, statistics from MASHAV — Israel's main agency for development cooperation — showed that Israel supported a dozen Centres of Excellence (CoEs) across six Indian states of Punjab, Haryana, Gujarat, Rajasthan, Tamil Nadu and Maharashtra putting agriculture at the 'front and center' of Indo-Israeli cooperation, also highlighting the role of states in India's development diplomacy (Embassy of Israel in India 2020b). During the historic visit of Indian PM Narendra Modi to Israel between 4-6 July 2017 — the first by any Indian head of government in history — the two sides agreed to further establish a *Strategic Partnership in Water and Agriculture*, with wide ranging implications for Indian agriculture and water management. The two sides also sought to expand and reinforce the scope of Indo-Israeli CoEs — jointly

supported by the Ministry of Agriculture, India and MASHAV — to give rise to more sustainable agricultural practices in India (Government of India and the Government of Israel 2017).

New Delhi relies on Berlin for capacity building and joint research in the frontier areas of S&T through German supported organizations in India such as the *Indo-German Science Centre for Infectious Diseases* (IG-SCID), *Indo-German Center for Sustainability* (IGCS), *Indo-German Science and Technology Center (IGSTC)*, *DST-German Research Foundation (DFG) Program*, and the *DST-Max Planck Society (MPG) Program* — which has given rise to initiatives such as the virtual *Indo-German Max Planck Centre on Computer Sciences* (IMPECS) and the *Indo-German Max Planck-NCBS Center for Research on Lipids*, located in the National Center for Biological Sciences, Bangalore. Beyond these collaborative research centres, Indian state organizations such as DST, Department of Biotechnology (DBT), Ministry of Earth Sciences (MoES) and Indian Council for Medical Research (ICMR) have also engaged with German institutions for joint S&T activities. On 4 October2010, India's DST signed the *FAIR Convention and Act* — with New Delhi committing to 3% of the net construction cost on equity basis — to participate in the *International Facility for Antiproton and Ion Research* (FAIR) project in Darmstadt, Germany aimed at undertaking applied research in high energy physics. On 31 May 2011, India also inked an agreement to contribute 14 million Euros to Deutsches Elektronen-Synchrotron (DESY), Germany to participate in applied research for scientific and industrial purposes (Embassy of India, Berlin 2019).

The Delegation of the European Union (EU) to India and Bhutan (2020) notes that: 'In the last few years, EU-India relations have evolved. As India has graduated from bilateral development assistance, reflecting its fast-paced economic growth, it has become a strategic development partner engaged with the EU on a wide range of issues' and — with the *EU-India Strategy (2018)* coming to force — 'emphasis is made on the importance of common responses to global and regional challenges which can broaden the EU-India cooperation'. The Delegation of the European Union to India and Bhutan (2020) further notes that: 'The EU's development cooperation in India, currently focuses on supporting India's transition to an upper middle-income status by addressing some of its key development priorities, such

as sustainable and inclusive growth, job creation and building sustainable infrastructure and human capital.'

The EU has contributed to disaster management in India through its European Civil Protection and Humanitarian Aid Operations (ECHO) — previous versions of which have been operating in India since 1995. ECHO has implemented early warning systems, disaster preparedness programmes and humanitarian relief to help India's national disaster management efforts. India benefits from EU's research and innovation programmes such as *Horizon 2020* and *Network of European and Indian Incubators*, which emphasizes on joint creation and development in close coordination with GoI organs such as the DST, DBT and MoES in areas of mutual interest. The EU-India Joint ICT Working Group and a Cyber Security Dialogue also bolster an already-strong ICT cooperation between the two entities. The EU further aids India in its efforts to secure healthcare, sustainable development, water management, clean energy, connectivity and natural resource management (Delegation of the European Union to India and Bhutan 2020).

India relies on cooperation with France for development of some of its most crucial civilian nuclear technology — including support to its Jaitapur nuclear power plant in shape of European pressurized reactors. French company AREVA has sold nuclear fuel to the state-owned Nuclear Power Corporation of India Limited since 2008, and Paris has also supported New Delhi's civil nuclear technology capacity building measures in areas such as research, safety and waste management. The two sides further cooperate in nuclear education and applied research, with India benefiting from French nuclear experience in applying nuclear technology in critical areas such as desalination of water (French Embassy in New Delhi 2020a). Since the conclusion of *Joint Vision for Space Cooperation* in 2018, an already historic partnership between the two states in space technology has been envisioned to extend to 'societal impact of space technologies, space surveillance and situation assessment, response to global challenges such as climate change, and development of technologies for human exploration of the universe' according to the French Embassy in New Delhi (2020c).

Paris' support to New Delhi extends to its crucial defence sector, and has manifested in both technology transfer and sale of defence systems to India — manifesting most notably with the *Scorpene* submarine project, built in India since 2008, and an agreement for Indian

acquisition of three dozen Rafale fighter jets. Since 2013, Indo-French ICT cooperation also extends to sensitive areas such as cybersecurity. Beyond defence, Paris supports New Delhi's *Smart Cities* scheme through its companies working in sustainable urban development in over a dozen Indian cities in areas such as rapid mass transit and water management. Both countries support the *Indo-French Centre for the Promotion of Advanced Research (IFCPAR/CEFIPRA)* in New Delhi. France and India jointly operate research laboratories in critical areas of common value such as neuroscience and chemistry (French Embassy in New Delhi 2020b).

Despite growing convergence with the US, India continues to benefit through joint R&D efforts with its longstanding strategic partner Russia — and both sides support dedicated research institutions such as *Russian-Indian Scientific and Technological Center* (RI STC), established in Moscow in 2010, and the *Russian–Indian Science & Technology Center*, opened in National Capital Region, India in 2012. Both sides further cooperate in S&T as part of the *Long-Term Program (LTP) of Science and Technology Cooperation* initiative. According to the Embassy of the Russian Federation in the Republic of India (2020), the main purpose of the LTP is to: 'enhance the role of applied research, boost interaction in the field of high technologies, implement fundamental and applied research in order to create new technologies, equipment and materials on their basis.'

The LTP has yielded dividends for bilateral S&T cooperation in mutual interest of both states. Over four dozen research institutions of both countries cooperate in S&T as an outcome. Multiple Russia-India Research Centers jointly address issues of common concern such as seismology, biotechnology, metallurgy, new materials, polyvaccines and gas hydrates. Furthermore, there have been more than five hundred bilateral R&D projects; over fifteen hundred joint publications; over eight dozen joint seminars; and close to three thousand exchange visits actualized by 2020 due to the vibrancy of the Indo-Russian LTP (The Embassy of the Russian Federation in the Republic of India 2020).

Both countries further created a new mechanism in the field of S&T cooperation on 21 June 2017 in the shape of the *Russian-Indian High-Level Committee on Scientific and Technical Cooperation* — with areas of cooperation falling under 'nuclear industry, space and laser technology, cancer treatment, radio-photonics, deep-sea research, new production

technologies, super-productive computer modeling, high-energy materials, biotechnology and pharmaceuticals' according to The Embassy of the Russian Federation in the Republic of India (2020). Both sides seek to develop closer cooperation in polar sphere for addressing climate change — with the feasibility of a joint project dedicated to the field being under consideration (The Embassy of the Russian Federation in the Republic of India 2020).

The long term objective of Japan's *Country Assistance Policy for India* is: 'Cooperation toward realizing faster, more inclusive and sustainable growth based on the shared values between Japan and India.' The medium term priority areas set by Japan's Country Assistance Policy for India are: enhancing connectivity, strengthening industrial competitiveness and supporting sustainable and inclusive growth (Embassy of Japan in India 2016). Japan has emerged as a valuable strategic partner in India's development, lending financial assistance in areas such as connectivity, infrastructure and capacity building. Tokyo's assistance to India partially finances its Delhi Mass Rapid Transport System as well as the Bangalore, Mumbai, Chennai and Ahmedabad Metro projects. Japan has also provided funding to other Indian development initiatives such as the Dedicated Freight Corridor, Ganga Action Plan, Yamuna Action Plan, IIT Hyderabad, Rajasthan Rural Water Supply and Fluorosis Mitigation Project, Gujarat Investment Promotion Program, and Haryana Distribution System Upgradation Project (Ministry of Finance, Government of India 2017b; 2018b; 2019b; 2020b).[46]

Indo-UK bilateral ties were enhanced to the level of strategic partnership in 2004, and New Delhi has since then relied on the London for cooperation in its attempts to achieve its national S&T objectives in diverse areas such as defence, cyber-security, connectivity, climate change, civilian nuclear technology, agriculture, water management, health and maritime security. Both countries also cooperate in the field of clean energy through the *India-UK Clean Energy R&D Centre* and further collaboration towards joint research and development of energy efficient building material was announced during British PM Theresa May's state visit to India in 2016. During Indian PM Modi's April 2018 visit to London, both

[46] Since 2013, India also supports a cyber-dialogue with Japan that has wider implications for enhanced cooperation with its other strategic partners such as the US given the convergence of mutual interests (Mallik 2016: 166-175).

sides agreed to enhance technological cooperation by launching a *NASSCOM-Tech UK tech alliance*, establishing the *UK-India Tech Hub*, developing *UK-India Tech Cluster partnerships*, setting up an *Advanced Manufacturing Centre* in India, and working towards incorporating ICT in India's healthcare. Both sides also hold a Joint Working Group on New Delhi's *Smart Cities* initiative and London's support to the *Skills India* program has also seen commitments in excess of 12 million GBP while its support to the *Start-Up India* initiative has seen investments in excess of 160 million GBP announced. UK and India further cooperate in the field of education through bilateral initiatives such as the *India-UK Education Forum*, *UK-India Education and Research Initiative*, *Joint Working group on Education* and the *Newton-Bhabha Fund* (High Commission of India, London, United Kingdom 2020).[47]

Since 2015, Singapore has emerged as a strategic partner of India and has lent its enthusiastic support to India's national development objectives. Singapore contributes to India's sustainable development projects — including its *Smart Cities* initiative — across states such as Rajasthan, Himachal Pradesh, Maharashtra and Gujarat. Singapore's support to India's skill development efforts manifests through institutions such as the *World Class Skill Centre* (WCSC), established in New Delhi in 2013 and the *North East Skill Centre* — inaugurated in Guwahati, Assam in March 2019. During PM Modi's 2018 state visit to Singapore, both sides agreed to set up an *Indian Institute of Skills* — which would be the first of its kind in the country — and a number of *National Trainers and Assessors Academies* in India. New Delhi also benefits from Singapore's expertise in financial technology to address its smooth transition to a more cashless economy and the two sides have maintained a *Joint Working Group on Fintech* since 2018. Both sides also cooperate in crucial areas such as maritime information, ICT, space and cyber-security (High Commission of India, Singapore 2020).

Another strategic partner that has recently begun to play a major role in India's rise is the UAE. During the August 2015 state visit of Indian PM Modi to the Gulf state, the two sides agreed to establish a *UAE-India Infrastructure Investment Fund* — with a target of investments worth 75 billion USD in India — for development of latest infrastructure in the

[47] India also enjoys ongoing cooperation with the UK that includes police cooperation in cyber security related law enforcement; and people-to-people exchange for addressing areas of mutual concern (Mallik 2016: 166-175).

shape of industrial corridors, roadways, railways, seaports, airports and industrial parks. UAE has already invested billions of USD in India for developing real estate, energy, infrastructure, housing, seaports, offshore drilling platforms, oil & gas plants, transport, renewable energy and hospitality projects (Embassy of India, Abu Dhabi, U.A.E 2020).

During the January 2017 state visit of Crown Prince Mohammed bin Zayed Al Nahyan to India, the Abu Dhabi National Oil Company (ADNOC) announced an agreement with Indian Strategic Petroleum Reserves (ISPRL) to establish a strategic crude oil reserve at the Indian city of Mangalore with the capacity to store 5.86 million barrels of crude oil from Abu Dhabi. In November 2018, ADNOC and ISPRL reached an MoU to explore further possibilities for storing Abu Dhabi's crude oil at ISPL's Padur underground oil storage facility in the Indian state of Karnataka. ADNOC and Saudi Arabia's Saudi Aramco have also agreed to support India in the development of its upcoming Ratnagiri Refinery and Petrochemicals Limited (RRPCL) project — a mega energy and petrochemicals initiative worth 44 billion USD with an objective to generate 1.2 million barrels of crude oil per day — by jointly participating in financial investment, building and later joint operation of the project in partnership with Indian companies with a 50 percent joint ownership (Embassy of India, Abu Dhabi, U.A.E 2020).

India and Australia declared a strategic partnership in 2009, and since then Canberra has been assisting India's rise in a wide range of areas. In its efforts to build stronger economic ties with India, the Government of Australia initiated the *India Economic Strategy* (IES) — published on 12 July2018 in the presence of Australian PM Malcolm Turnbull — to define the future pathway of Canberra's relations with New Delhi until 2035. The paper identifies education as the flagship sector to focus bilateral cooperation while the lead sectors include agribusiness, resources and tourism. Promising sectors in the paper are identified as energy, health, financial services, infrastructure, sports and science & innovation. The paper further identifies Indian territories of Andhra Pradesh, National Capital Region, Gujarat, Karnataka, Maharashtra, Punjab, Tamil Nadu, Telangana, UP and West Bengal as geographical areas where Australia should focus its bilateral efforts. The IES recommends increasing Australian investments in India to 100 billion USD by 2035 and was cited by PM Turnbull as the guiding

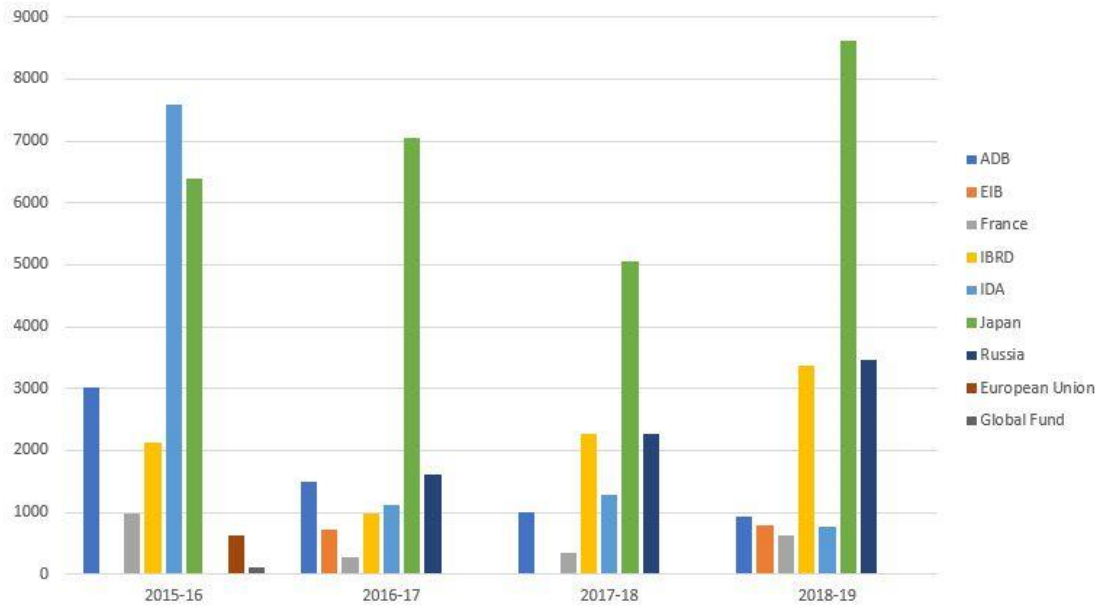
policy in principle during the state visit of Indian President Ram Nath Kovind to Australia in November 2018 (High Commission of India, Canberra, Australia 2020).

Australia is also a strategic partner to India in the civilian nuclear domain. The two countries signed a Civil Nuclear Cooperation Agreement during Australian PM Tony Abbott's September 2014 state visit to India, and the agreement came into force on 13 November 2015. On 1 December 2016, the parliament of Australia passed the *Civil Nuclear Transfer to India Bill 2016* — to enable a steady supply of uranium and other nuclear technology for civilian purposes to India without domestic legal hindrance. In addition of earlier financial commitments to jointly develop solutions to secure energy, food, water, health, and environment — both countries also support the Australia-India Strategic Research Fund (AISRF), with a contribution of 65 million USD made by each side. The Centre for International Agricultural Research (ACIAR) supports joint research for dry-land irrigation in India. Both sides also maintain a Bilateral Dialogue on Global Cyber Issues, Joint Committees on S&T and Biotechnology, a Joint Working Group on Energy and Minerals and the Australia-India Education Council for further cooperation in S&T. During the November 2014 state visit of PM Modi to Australia, Canberra agreed to transfer clean coal technology to India and further intended to upgrade the *Indian School of Mines*, Dhanbad. Australia supports India's efforts for water management such as the Clean Ganga Project. During his August 2015 state visit to India, Australian Minister for Education and Training, Christopher Pyne also inaugurated the joint *IIT Bombay-Monash University* campus in Mumbai (High Commission of India, Canberra, Australia 2020).

During the April 2015 state visit of PM Modi to Canada — the High Commission of India, Ottawa, Canada (2020) notes that 'the Indian side sought Canada’s cooperation and investment in every area of India’s national development priority – Energy and Infrastructure, Manufacturing and Skills, Smart Cities and Agro-industry and Research and Education.' Both sides hold a *Joint Energy Dialogue* and a *Joint Committee on Civil Nuclear Technology*, and — since 2015 — Canada's Cameco has agreed to provide supply of uranium ore concentrate to India's DAE until 2020. India also has an agreement with the Canadian Nuclear Safety Commission (CNSC) since September 2015 for exchanging information and practices in nuclear safety and regulation. India's DST and the Natural Sciences and

Engineering Research Council, Canada (NSERC) have initiated the *India-Canada Centre for Innovative Multidisciplinary Partnership to Accelerate Community Transformation and Sustainability* (IC-IMPACTS) program to jointly work on projects in areas such as sustainable development, energy conservation, health, biotechnology and water management. The *Shastri Indo-Canadian Institute (SICI)* — located both in Calgary, Alberta, Canada and New Delhi, India — has further facilitated academic links between the two countries since 1968 (High Commission of India, Ottawa, Canada 2020).

Another emerging source of technology for India is South Korea (RoK) — with which New Delhi has had a strategic partnership since 2010. The two sides have been cooperating in civilian nuclear energy since 2011 and have further launched the *Korea Plus* initiative in June 2016 to boost South Korean investment in India. RoK has supported India's capacity building efforts through the launch of the *Korea India SME and Start-up Centre* in September 2019. Both sides also cooperate in bilateral research in areas such as ICT and biotechnology (Embassy of India, Seoul, Republic of Korea 2020).



Actual receipts for large externally aided projects in INR crores under the central sector of India, FY 2015-16 to 2018-19 — compiled using data from Ministry of Finance, Government of India (2017b; 2018b; 2019b; 2020b).

Sum of Actual Receipts (in INR Crores)										
Fiscal Year	ADB	EIB	France	IBRD	IDA	Japan	Russia	European Union	Global Fund	Grand Total
2015-16	3016.97	0	971.7	2128.3	7578.43	6397.4	0	625	113.83	20831.63
2016-17	1497.24	730.72	282.44	972	1108.35	7037.54	1605.79	0	0	13234.08
2017-18	1011.98	0	355.2	2258.51	1275.81	5060.55	2255.68	0	0	12217.73
2018-19	939.15	798.55	629.46	3362.68	755.39	8624.57	3457.23	0	0	18567.03
Grand Total	**6465.34**	**1529.27**	**2238.8**	**8721.49**	**10717.98**	**27120.06**	**7318.7**	**625**	**113.83**	**64850.47**

Sum of actual receipts for large externally aided projects in INR crores under the central sector of India, FY 2015-16 to 2018-19 — compiled using data from Ministry of Finance, Government of India (2017b; 2018b; 2019b; 2020b).

By FY 2015-16, India's sources for funding its development projects at a central level were narrowed down primarily to multilateral organizations such as the Asian Development Bank (ADB), European Investment Bank (EIB), International Bank for Reconstruction and Development (IBRD), International Development Association (IDA) and the Global Fund. Despite this intentional shift, New Delhi also continued to rely on its strategic partners in the EU, France, Japan and Russia for funding a significant share of its critical development projects (Ministry of Finance, Government of India 2017b; 2018b; 2019b; 2020b).

New Delhi has relied on ADB for funding its connectivity, health, urban development, and clean energy initiatives — securing finance for key projects such as the Rural Connectivity Investment Program, North Eastern State Roads Investment Program, National Eastern Region Capital Cities Development Investment Program, Railway Sector Investment Program and the National Urban Health Mission. IBRD has provided India with assistance for infrastructure, capacity building, water management, and connectivity projects. This has manifested in support to initiatives such as the Swachh Bharat Programme, National Highways Interconnectivity Improvement Project, National Ganga River Basin Project, Technology Centre Systems Programme, Eastern Dedicated Freight Corridor and North Eastern Region Power System Improvement Project (Ministry of Finance, Government of India 2017b; 2018b; 2019b; 2020b).

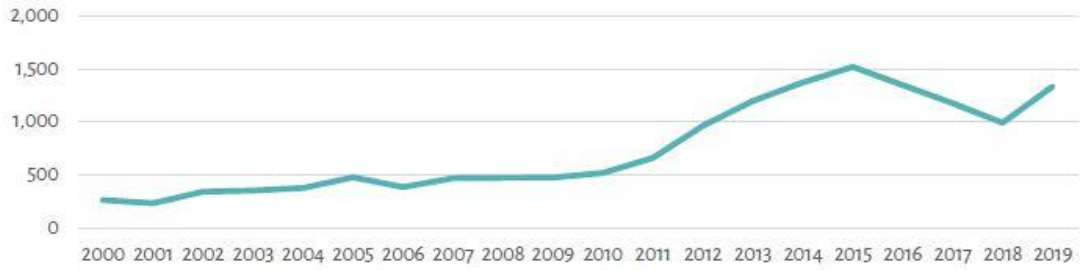
India has relied on IDA for its natural resource management, natural disaster mitigation, technical education, health and capacity building projects. IDA has helped New Delhi finance

its national development schemes such as the Jal Marg Vikas Project, Integrated Coastal Zone Management Project, National Dairy Support Project, National Cyclone Risk Mitigation Project, Elementary Education Project, National AIDS Control Support Project and Pradhan Mantri Gram Sadak Yojana Rural Roads Project. The EIB has provided financial support to Lucknow Metro Rail Project while the Global Fund has assisted the country's efforts against Tuberculosis (Ministry of Finance, Government of India 2017b; 2018b; 2019b; 2020b).

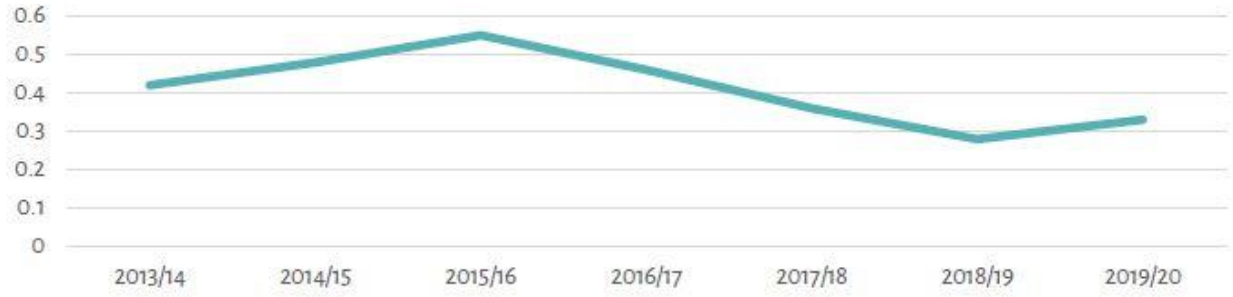
Throughout the ongoing COVID-19 pandemic, India's diplomacy had been at the forefront to secure critical medical supplies to aid the country's efforts against the virus. By April 2020, India had managed to ensure arrival of ventilators from such diverse sources as the US, Germany and China. New Delhi also looked towards the US, Germany, Taiwan and Switzerland for the supply of core components required to manufacture ventilators in India. Indian diplomats also managed to secure the supply of hundreds of thousands of testing kits to the country from sources such as China, South Korea, the UK, Ireland and Malaysia. New Delhi also relied on private sector in Singapore for supply of millions of face masks and on other countries for the supply of millions of Personal Protective Equipment (PPE), meant to aid national efforts during the health emergency (Bagchi 2020).

India would secure a small but timely and welcome amount of financial aid from its strategic partner the US in the form of a 5.9 million USD health assistance package by April 2020 — meant to aid New Delhi's efforts to curb the spread of COVID-19 within its geographical boundaries (Business Standard 2020). India would also rely on Japan — another strategic partner in the international system — for supporting its efforts to contain the COVID-19 pandemic through Official Development Assistance (ODA) grants and loans. The country also secured life-saving equipment from Israel and France, while relying on the World Health Organisation (WHO) for technical assistance and capacity building (Choubey 2021b).

S&T Diplomacy, Development Cooperation and India's External Affairs



India's development assistance commitments in USD million in the 21st Century (Mullen 2019: 3).



India's outbound foreign assistance commitments as a percentage of its national budget (Mullen 2019: 4).

India's development assistance in INR billion under Narendra Modi administrations (Mullen 2019: 2).

In the 21st Century, a Rising India has steadily emerged as a leading provider of development assistance in the international system — though not one without fluctuations in terms of financial commitments — but the overall share of New Delhi's foreign assistance commitments has remained well below one percent of its national budget even during recent years. Furthermore, Indian aid flows under New Delhi's own strategic intentions and is driven by its foreign policy calculations falling under its *Neighborhood First*, *Act East* and *Indo-Pacific* strategies — among others (Mullen 2019: 1-4).

India's aid to South Asia — which manifests in the form of grants, lines of credit, soft loans, and provision of experts, information, training and project aid — is guided by the principles of non-interference and *Panchsheel*, or the five principles of peace. The notion of India having a single, unified approach to aid provision in South Asia may not hold true in actual diplomatic practice. Instead, the South Asian giant has a nuanced approach to aid diplomacy towards each of its regional partners — with the exception of Pakistan, which has not been a major recipient of Indian aid for its own reasons — depending upon bilateral equations with an over-arching objective of achieving leverage and primacy in South Asia, where the bulk of Indian aid has traditionally been apportioned. India has sought to realize its foreign policy objectives through aid diplomacy in South Asia by tapping into its own vast reservoir of skilled manpower and its versatile industrial capabilities (Abrol 1989: 37-38).

During the 1990s, India sought to bolster its position as a regional power through its S&T capabilities in South Asian forums such as SAARC. In his address to the 10th SAARC Summit held in Colombo on 29 July1998, Indian PM Atal Bihari Vajpayee (1998a: 62-66) urged SAARC member states to 'identify and implement specific technology initiatives which would have a direct impact in improving living conditions' in their respective rural areas. Vajpayee (1998a: 62-66) stated Indian willingness to 'host a special Meeting of SAARC Ministers for Science and Technology to consider such a SAARC Technology initiative' and further went on to offer to host a meeting of SAARC Health Ministers for cooperation in the area of traditional medicine. Vajpayee (1998b: 72-75) would later reiterate these commitments in front of a joint session of both houses of the parliament in New Delhi on 3 August 1998.[48]

India's Special Secretary (Public Diplomacy) Jayant Prasad — while addressing the *Workshop on Science, Diplomacy and Policy* held in Bangalore, India on 12 January 2011 with representation from the country's National Institute of Advanced Studies (NIAS) and American Association for the Advancement of Sciences (AAAS) — noted that by 2011, India was still rising as a donor state in the international system with a focus on science that had yet to be integrated as a 'core foreign policy concern.' Prasad (2011: 18) further situated India as a state that had yet to 'learn how precisely to mainstream science and technology in our growing development partnerships and assistance programmes' despite having 'pursued science-based initiatives in our interaction with fellow developing countries.' Prasad (2011: 18) outlined the need for greater strategic planning and prioritization for India's science-based diplomacy. Prasad further contended that 'better articulation and implementation of science-based diplomacy and development initiatives will particularly resonate, in a positive way, with our partner countries, who share problems similar to the one's faced by us' (p. 18).

However, despite a frank and candid articulation on scope for improvement in India's approach towards integrating S&T in its development cooperation programme, Prasad

[48] Vajpayee (1998b: 72-75): 'We underlined the importance of cooperation in energy through networking. India has, further, offered to host a special meeting of Science and Technology Ministers to consider a SAARC S&T initiative for regional projects in rural areas, directly benefiting the people. We also underlined the utility of cooperation in traditional systems of medicines and have invited participation in a Health Ministers' meeting in India for this purpose. India has reaffirmed support for comprehensive environment related proposals.'

(2011: 14-16) also outlined that S&T already played a vital part in some of the country's most important development cooperation initiatives — such as providing assistance to its war-torn South Asian strategic partner Afghanistan. Prasad stated that India operated five medical missions in Afghanistan that provided free healthcare and medicines, and the country also provided modern nutrition supplements in form of high protein biscuits approved by the World Food Programme (WFP) to millions of Afghan schoolchildren. India's Small Development Projects (SDPs) — with a budget cap of under a million USD and a generally lower expenditure range — have resulted in a steady rise of schools, clinics, irrigation and power projects in the country.

As per Prasad — between 2008-2011, India had implemented 50 SDPs in Afghanistan with the proposal, concept and implementation being led by the local people. Furthermore, India provided Afghanistan with skill development assistance by training its citizens in elite institutions across multiple areas such as civil administration, IT, S&T and medicine. Telecommunications Consultants India Limited (TCIL) also aided in provision of telemedicine services to the Indira Gandhi Institute for Child Health (IGICH), Kabul — one of the largest children's hospitals in the country — by linking it to advanced Indian medical facilities for medical purposes such as tele-surgery and diagnostics. Prasad (2011: 14-16) also noted the role of the ITEC programme as a capacity building initiative meant for the Global South and pointed out that the Pan-African e-Network — which would link four dozen African countries with Indian medical and educational institutions through ICT — had been well received in Africa.

The recent strategic and geo-political rationale behind India's development assistance programme was more clearly articulated on the house of the country's Lok Sabha on 06 February 2019 by EAM Sushma Swaraj in response to a question put forth by the MP Sushil Kumar Singh (Singh 2019), who had asked if the GoI had provided 'any development assistance to any other country' in FY 2017-18 with a request for details and had further inquired about the nature of India's outbound development assistance from 2008-2017 — with an emphasis on Small Development Projects (SDPs). In her response, EAM Swaraj (2019) situated India's development assistance as a 'key instrument' in the country's foreign

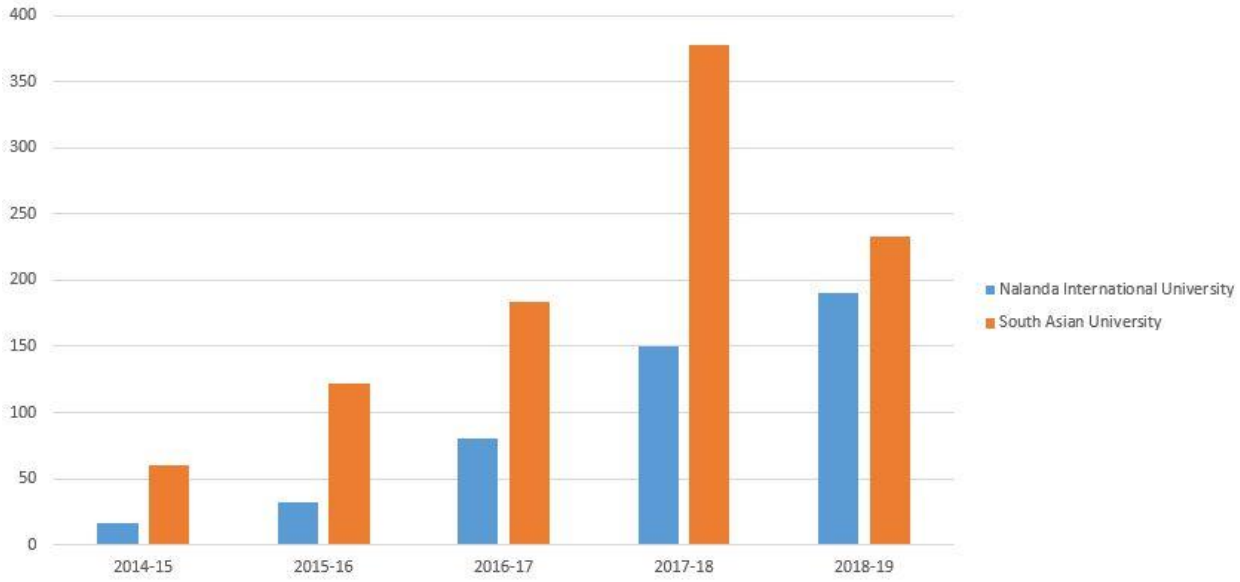
policy which had seen expansion in terms of both its scope and reach during the latter half of the 2010s.

Swaraj (2019) linked India's efforts for greater engagement with the Global South with the country's 'abiding geo-political, strategic and economic interests' and 'the need to effectively deliver India's assistance programme.' Swaraj further stated that India's strategy to provide development assistance relied on the requirements of the recipient state and its own financial and technical wherewithal. According to Swaraj, the traditional focus of India's development assistance was South Asia and Africa but a Rising India also increasingly sought to expand its engagement to not only South East, East and Central Asia — but to states in Latin America the Indo-Pacific region. Swaraj also stated that 'the main instruments of India's development assistance include Lines of Credit (LOC), Grant assistance, Small Development Projects (SDP), Technical Consultancy, Disaster Relief and Humanitarian aid, as well as capacity-building programmes under Indian Technical and Economic Cooperation Programme (ITEC).'

Swaraj confirmed that India's grant assistance was focused on South Asia with an added emphasis on expansion beyond the region. The country's 274 LOCs between FY 2005-06 to January 2019 extended to 63 states — amounting to an aggregated total of USD 26.79 billion — had also conformed to the Indian strategy of focusing on Asia and Africa, since India had allocated 53 LOCs for Asian states amounting to USD 14.47 billion and 189 LOCs for African states amounting to USD 11.36 billion. Swaraj attributed the increase in India's development assistance to Africa to the third India-Africa Forum Summit in 2015.

Swaraj further noted that India's ITEC programme had offered capacity building slots to as many as 161 states with full sponsorship by the GoI in FY 20017-18. And that the country had deputed 49 experts on November 2017 to aid its partners in the Global South in areas such as ICT, agriculture, language and traditional medicine. Swaraj situated Indian aid to states affected by natural disasters as manifesting in terms of medicine, food, infrastructure and financial assistance. And further situated Small Development Projects (SDPs) as an 'active pillar of India's development assistance to foreign countries' focused in South Asia and the Indo-Pacific region.

In terms of India's regional diplomacy in South Asia, Goel (2018: 9-10) notes the role of S&T in spurring international cooperation in a state's national interest — even amidst political differences — in the 21st Century and situates India as being the first developing state to take to provision of aid to its South Asian neighbors since the 1950s with the aim of building regional ties by contributing to their national progress through development cooperation in areas such as infrastructure, communications, health, energy, education, industry, agriculture and skill development. Goel (2018: 9-10) also views India's diplomatic miscalculations, including its idealist policy of non-reciprocity while extending aid to South Asia during the Inder Kumar Gujral administration in the 1990s, as having aroused both suspicion and disinterest among its regional neighbors.

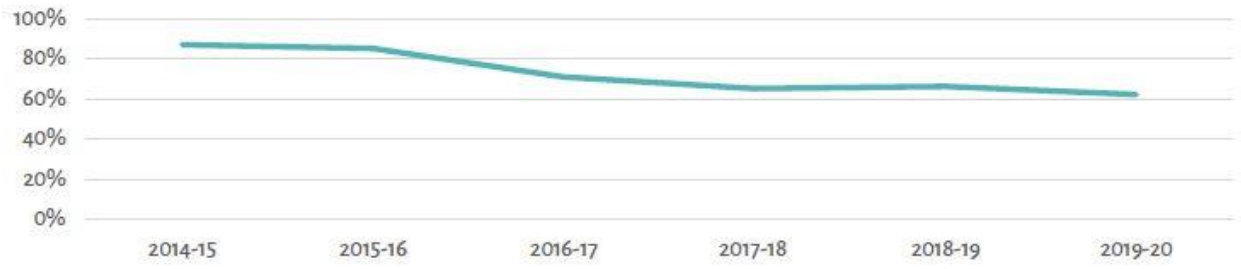


Actual expenditure by India in INR crores on its South Asian University and Nalanda International University projects between FY 2014-15 to 2018-19 — compiled using data from the Ministry of Finance, Government of India (2016; 2017a; 2018a; 2019a; 2020a).

Sum of Actuals in INR Crores			
Fiscal Year	Nalanda International University	South Asian University	Grand Total
2014-15	17	60.08	77.08
2015-16	31.67	122.1	153.77
2016-17	80.23	183.77	264
2017-18	150	377.62	527.62
2018-19	190	232.5	422.5
Grand Total	**468.9**	**976.07**	**1444.97**

Sum of actual expenditure by India in INR crores on its South Asian University and Nalanda International University projects between FY 2014-15 to 2018-19 — compiled using data from the Ministry of Finance, Government of India (2016; 2017a; 2018a; 2019a; 2020a).

Goel (2018: 10-11) states that India has persevered in its efforts to cement ties with its regional partners in the 21st Century by employing development cooperation initiatives which fall under the ambit of Science Diplomacy such as South Asian University (SAU) and South Asia Satellite (SAS). Goel (2018: 11-12) asserts India's lead in disaster management cooperation in South Asia by pointing towards the Tsunami Warning System at Indian National Centre for Ocean Information Sciences (INCOIS) — with capability of issuing quick warnings to India and the region — and to joint exercises such as South Asian Annual Disaster Management Exercise, initiated in 2015. Furthermore, the Gujarat Institute of Disaster Management hosts the interim unit of the SAARC Disaster Management Centre (SDMC) since 2016. Goel (2018: 10-11) also notes that New Delhi hosted the Asian Ministerial Conference for Disaster Risk Reduction (DRR) in 2016 in which the Asian Regional Plan for Implementation of Sendai Framework first took shape.



South Asia's share in India's total foreign assistance has been declining since the advent of the Narendra Modi government (Mullen 2019: 5).

In terms of financial wherewithal, India's *Neighborhood First* policy — which arose under the first Narendra Modi administration to ensure New Delhi's regional primacy in South Asia — may not have materialized as optimally in practice as it has in invocation since the country's overall share of foreign assistance to its South Asian neighbors has consistently declined as a percentage of its overall outbound assistance between FY 2014-15 to FY 2019-20. However, given the advent of the pro-India Ibrahim Solih administration in Maldives — and with the defeat of the pro-China President Abdulla Yameen — India increased its outbound aid to the South Asian country by a four-fold year-on-year margin in FY 2019-20, amounting to a total of 4 billion INR in grants and 1.76 billion INR in loans. In order to counter increased Chinese influence in Nepal, India's external commitment to its Himalayan neighbor also increased from 6.6 billion in FY 2018-19 to 10.5 billion in 2019-20 (Mullen 2019: 4-5).[49] Furthermore, statistics from Exim Bank of India (2020) for Asia between FY 2002-03 to FY 2019-20 — amounting to more than 15.42 billion USD — confirm that India's outbound development assistance for South Asia has been dominated by the civilian S&T component in terms of Lines of Credits (See Appendix 3 for details).

Post-liberalization, India would go on to utilize its S&T capabilities to foster closer development partnerships with multilateral groupings in South East Asia such as ASEAN. On 16 November 1996, during the First ASEAN — India Joint Cooperation Committee Meeting

[49] Selvamurthy (2019b) notes that competition from the external environment impacts India's rise as a donor of S&T in the international system. Since any potential recipient state has other options of donors than India in the international system, it narrows down New Delhi's window of opportunity by making international cooperation more competitive.

in New Delhi, the two sides acknowledged the importance of the Joint Cooperation Committee (JCC) in providing input and support to implementation of upcoming joint ASEAN-India projects meant to realize practical cooperation in the spirit of Pan-Asian, Asia-Pacific and South-South cooperation. The JCC allowed for establishment of ASEAN-India Joint Working Groups on S&T as a key outcome. The JCC also took note of India's advanced S&T capabilities and sought practical cooperation between ASEAN and India in the areas of advanced materials, biotechnology and ICT (ASEAN and the Government of India 1996: 156-158).[50]

This *Look East Policy* morphed into *Act East Policy* under the first Narendra Modi administration. However, these policies — meant to prioritize South East and East Asia in India's foreign policy calculations — have yet to figure prominently in the country's outbound development assistance given the lack of financial allocations despite a strong S&T component (Mullen 2019: 6; See Appendix 3 for details of the S&T component).

Incumbent Indian President Ram Nath Kovind — in his address *India and the Global South*, delivered at the University of Havana, Cuba, on 22 June2018 — stated that 'India has placed science and technology at the center of its development cooperation strategy'. Kovind further sought to situate India's development assistance through its Indian Technical and Economic Cooperation (ITEC) program; its extension of USD 10 billion Line of Credit to Africa; and its USD 2 billion support towards the International Solar Alliance as examples of India's solidarity with its partners in the Global South.

Kovind (2018) also sought to establish Centre for Geo-informatics Applications in Rural Development in Madagascar as an example of India's assistance in the realm of space technology. Kovind (2018) situated India's Pan-African E-Network as a measure bringing the benefits of tele-medicine and tele-education to fellow developing states in Africa. Kovind

[50] Lele (2019b) notes that during recent times, India's S&T cooperation has become more multilateral in nature. However, its cooperation with the regional grouping South Asian Association for Regional Cooperation (SAARC) has become dormant while its cooperation with both BIMSTEC and ASEAN enjoys newfound activity. Lele notes the role of S&T in India's diplomatic engagement with groupings outside its region such as SCO and BRICS. Department of Science and Technology, Government of India (2019b) further informs that India's S&T cooperation with member states associated with the Global North has increased in the 21st Century but the rising power also maintains close S&T ties with its partners in the Global South such as Africa through programs such as the India-Africa S&T Initiative and with South-East Asia as a component of its larger Act East Policy.

(2018) sought to situate India as being 'quick to factor in the changing technology landscape in our approach' by initiating programs in the frontier areas of S&T which 'could well be a game-changer for development across the Global South.' Kovind (2018) further called for greater participation of states of from the Global South in the global governance structures, such as a reformed United Nations Security Council.

In terms of S&T projects facilitated by India in Africa, The Ministry of External Affairs, Government of India (2020b) lists its Milk Processing Plant in Mauritania inaugurated in May 2016; the construction of the National Assembly Building Complex in Gambia in September 2014; the inception of the Komenda Sugar Plant in Ghana in November 2016; the building of an IT Park Project in Mozambique in November 2014 and in Swaziland in September 2016; Hydel Power Plant project inaugurated in April 2016 in Zambia; Water Supply project to Dar-es-Salam, Tanzania; Nyaborongo Hydro-Power Project in November 2014 in Rwanda; and Kosti Power Plant in Sudan, inaugurated in October 2015 as representative examples. According to Exim Bank of India (2020), India's outbound Lines of Credit to Africa amounted to a grand total of more than 11.97 billion USD between FY 2002-03 and 2019-20, with the S&T component dominating the development initiatives (Ministry of External Affairs, Government of India 2020b; Exim Bank of India 2020).

While the Act East policy may have fluctuating support from the Modi administration, a foreign policy imperative that has seen increased focus under the incumbent GoI is India's *Indo-Pacific* strategy — meant to ensure a rule based order and check China's perceived hegemony in the region. New Delhi's more recent focus on the Indo-Pacific has not only been on the Indian Ocean Rim states but also on states such as Iran and Mauritius — both of which have greater per capita GDP than India. New Delhi agreed to provide Port Louis with a 52.3 million USD LoC for upgrading its maritime and surveillance technology and went on to allocate 5 million USD to Mauritius in FY 2018-19 — only to further grant 161 million USD to its same partner in the Indian Ocean Region in FY 2019-20 (Mullen 2019: 7).

India's LoC's to the Indian Ocean region have also shown an upswing in terms of S&T-based development cooperation in the 21st Century. The country approved 50.40 million USD LoC to Fiji for restructuring its sugar industry in FY 2005-06, and went on to approve another 5.38 million USD LoC to Fiji for upgrading its sugar industry in FY 2012-13. India also

approved an LoC worth 100 million USD in FY 2016-17 to Papua New Guinea for the development of its roadways and infrastructure. New Delhi further allocated Seychelles with 3000 million INR separately in both FY 2017-18 and 2018-19, and went on to allocate another 1000 million INR to Victoria in FY 2019-20 (Exim Bank of India 2020; Ministry of External Affairs, Government of India 2020b).

Asher (2017: 1-2) situates the *Asia Africa Growth Corridor* (AAGC) — first emerging from a joint declaration between India's PM Narendra Modi and Japan's PM Shinzo Abe in November 2016 — as an effort that has the potential to benefit several independent developing states. Asher (2017: 1-2) states that 'the initiative comprises four pillars: development and cooperation projects, quality infrastructure and institutional connectivity, enhancing capacities and skills, and people-to-people partnership.' The AAGC is further oriented towards ensuring freedom and openness in the Indo-Pacific and acts as an instrument of India's Act East Policy. The AAGC may also have a bearing on India's *Sagar Mala* project.

The AAGC envisions African states as partners and collaborators in terms of development cooperation instead of recipients of Indo-Japanese aid. The AAGC further has the potential to lead as a development cooperation initiative in the international system in an era that has witnessed the decisive rise of the One Belt One Road (OBOR) project, emanating from the People's Republic of China. But India and Japan require to conclusively undertake projects that positively impact developing states while aligning their own cooperation in a manner that optimally addresses shared development challenges (Asher 2017: 3-6).

In the 21st Century, India has also emerged as a provider of LoCs to the post-Soviet Commonwealth of Independent States (CIS), centered in Eurasia. India approved an LoC for Belarus worth 55.60 million USD in FY 2008-09 for the reconstruction of the country's Grodno-II power plant project. India's approved LoCs to Uzbekistan amounted to 200 million USD in FY 2018-19 — meant for housing and social infrastructure — and to 40 million USD in FY 2019-20 for financing purchase of defence technology. In FY 2019-20, India approved an LoC to Russia worth one billion USD for its infrastructure and development requirements (Exim Bank of India 2020).

The case of Rising India's development assistance to Russia is remarkable in its own right because since its independence and until its rise, India looked towards the Soviet Union — a predecessor to the modern Russian Federation — for meeting its national needs in such vital areas as modernization of its industrial base (Gujral 1997: 16-18). According to Indian PM Inder Kumar Gujral (1997: 16-18) — in his address *India and the World*, delivered on the floor of the country's Rajya Sabha on 29 August 1997 — ties with the Soviet Union made India 'look at the world in a different fashion with courage'. Gujral (1997: 17) duly noted that the Soviet Union had now dissolved but also stated that 'our friendship with Russia and friendship with all those who at one time were part of the Soviet Union, is an abiding friendship' and further went on to note that 'today, fortunately for us, after fifty years having come to that level of development, we can also give to ex-Soviet Union something back.' For New Delhi, friendship with Moscow had not fallen either with the fall of the Soviet Union or with India's own rise (Gujral 1997: 18).

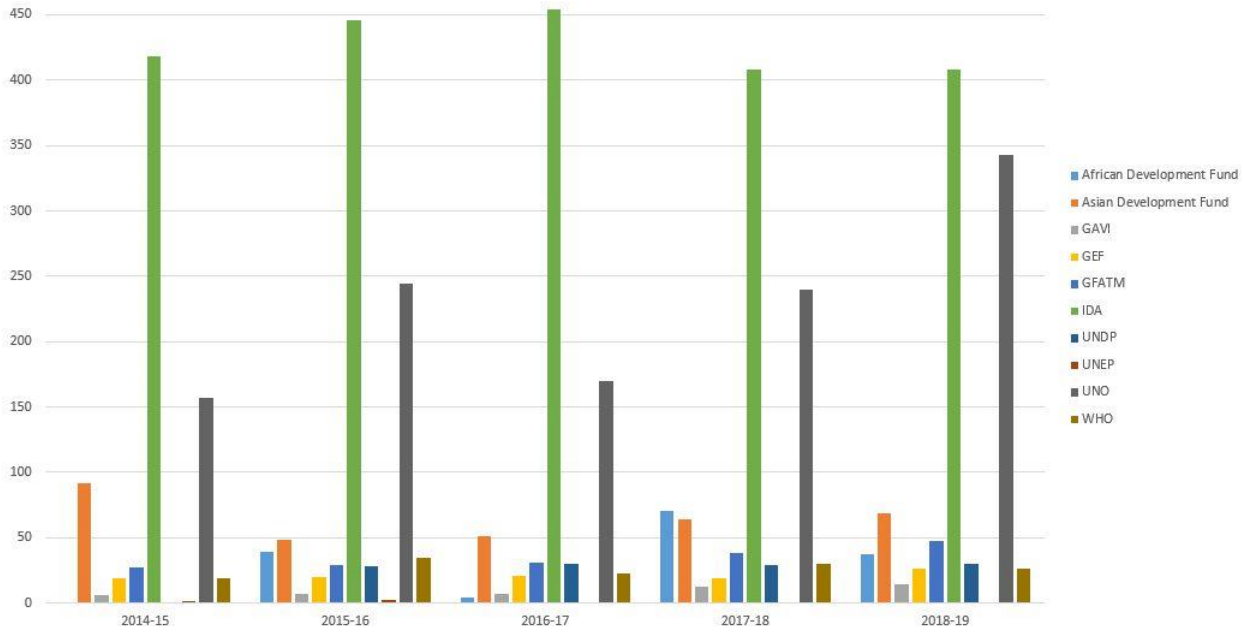
Since 2014, Moscow's economy struggled after its intervention in Crimea — which invited US-led sanctions — and a decline in global oil prices. This led to a Rising India — itself keen to exert greater influence in Russia and aware of the need to balance China's Belt and Road initiative — to emerge as a donor to a state from which it had a long history of receiving aid (Times of India 2019). On 5 September 2019 — while addressing the plenary session of 5th Eastern Economic Forum (EEF) in Vladivostok, Russia — Indian PM Narendra Modi reaffirmed the country's commitment to the development of its longstanding strategic partner Russia, and extended a one billion USD Line of Credit for the development of its Far Eastern region, which accounts for the bulk of the country's diamond and gold resources. This Line of Credit came as Indian businesses had already invested in the region for oil & gas, coal, diamond and gold projects but the scale of the investment was still limited (Kondratieva 2019).

According to the Press Trust of India (2021) — during the ongoing COVID-19 pandemic — the US State Department expressed its willingness to ensure a greater degree of health cooperation with India to build upon an already robust strategic partnership. Press Trust of India (2021) noted existing Indo-US joint vaccine development cooperation as: 'Bharat Biotech and Precision Virologics (based in St Louis, Missouri); Bharat Biotech and Thomas

Jefferson University, Philadelphia; Serum Institute of India and Codagenix; Serum Institute and Novavax; Bharat Biotech and University of Wisconsin-Madison and Flugen; and Pune-based Gennova and HDT Biotech Corporation, Seattle.' By 12 February 2021, India had supplied 20 states in the international system with COVID-19 vaccines on either aid or commercial basis while ensuring supply for its own national needs (Choubey 2021a). New Delhi had also empowered India's private pharmaceutical actors such as the Serum Institute of India and Bharat Biotech to export vaccines to other states in the international system which required such medical provisions (Puri 2021).

India's Union Minister of State for External Affairs & Parliamentary Affairs Vellamvelly Muraleedharan (2021) — on detailing India's role in the international system after the ongoing pandemic — stated that although the country did not field a single formal strategy in letters, it was committed to ensuring sovereignty, security, economic transformation and international influence in the post COVID-19 international system in cooperation with its strategic partners and diaspora. Ministry of Science and Technology, Government of India (2020: 50) contends that the post COVID-19 situation presents India with both issues and opportunities to be addressed through international S&T cooperation.

According to Kalita (2021) — since the fall of the original Taliban in Afghanistan in 2001 — India implemented development projects worth over 3 billion USD in the country in sectors such as health, hydropower and education. However, given a second rise of the Taliban in the country since 2021, the future of Indo-Afghan ties remains uncertain. Furthermore, the 2021 Myanmar coup d'état further complicates things for India along its western border — testing its *Neighborhood First* policy and related S&T cooperation.



Actual contributions made by India in INR crores to select international organizations since the advent of the Narendra Modi administration — compiled using data from the Ministry of Finance, Government of India (2016; 2017a; 2018a; 2019a; 2020a).[51]

Sum of Actuals in INR Crores											
Fiscal Year	**African Development Fund**	**Asian Development Fund**	**GAVI**	**GEF**	**GFATM**	**IDA**	**UNDP**	**UNEP**	**UNO**	**WHO**	**Grand Total**
2014-15	0	91.42	6.22	19	27.26	417.98	0.66	1.24	156.94	19.42	740.14
2015-16	38.82	48.09	6.69	19.92	28.78	445.82	28.66	2.11	244.48	34.83	898.2
2016-17	3.87	50.83	6.81	20.55	30.57	454.13	30.26	0.67	170.28	22.68	790.65
2017-18	70.35	64.5	12.99	19.34	38.74	408.33	29.46	0.67	239.47	30.01	913.86
2018-19	37.02	68.97	14.23	26.6	47.72	408.33	30.27	0.68	343.17	26.07	1003.06
Grand Total	**150.06**	**323.81**	**46.94**	**105.41**	**173.07**	**2134.59**	**119.31**	**5.37**	**1154.34**	**133.01**	**4345.91**

Sum of actual contributions made by India in INR crores to select international organizations since the advent of the Narendra Modi administration — compiled using data from the Ministry of Finance, Government of India (2016; 2017a; 2018a; 2019a; 2020a).

[51]Figures for the African Development Fund compose of the actual contribution towards the fund plus that towards the multilateral debt relief initiative. Similarly, figures for the Asian Development Fund include a composite amount for ADB and ADB-12.

India contributes to international organizations with a mandate for addressing global challenges such as the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM), the IDA, United Nations Organization, Asian Development Fund, African Development Fund, the Global Environment Facility (GEF) and the World Health Organization (WHO) — although the extent of much of this financial cooperation still remains modest in comparison to India's bilateral assistance initiatives and it can further be prone to visible fluctuations between fiscal years (Ministry of Finance, Government of India 2016; 2017a; 2018a; 2019a; 2020a).

However, 21st Century India has also relied on triangular cooperation to provide development assistance to its partners in the Global South.[52] The 2017 *India-Portugal Joint Declaration on Cooperation in Third Countries* — reached between New Delhi and Lisbon on 7 January 2017 — elaborated a bilateral intention to jointly work on economic and commercial affairs in third countries, including supporting projects in coordination with the third country to benefit the participant according to its national needs and priorities while adhering to the best practices in development cooperation (Government of India and the Government of Portugal 2017). The Indo-Russian *Saint Petersburg Declaration* of 1 June 2017 also seeks to forward bilateral scientific, technical and economic cooperation to third countries by fostering joint development initiatives in sectors agreed upon by all parties (Government of India and the Government of the Russian Federation 2017). The *India-UAE Joint Statement* of 11 February 2018 — reached as an outcome of Indian PM Modi's state visit to the Gulf kingdom — states that both countries seek to transform their partnership in the energy sector and further sought joint energy exploration cooperation in third countries (Government of India and the Government of the United Arab Emirates 2018). The 15 January 2018 *India-Israel Joint Statement* — reached as an outcome of PM Benjamin Netanyahu's state visit to New Delhi — confirms that the two countries seek to jointly promote solar technology in third countries and further seek ways to device joint development assistance programmes for third countries in agriculture, water, healthcare and education sectors (Government of India and the Government of Israel 2018).

[52] UNDP (2017) situates the UN's working definition for triangular cooperation — in the context of South-South cooperation — as 'Southern-driven partnerships between two or more developing countries, supported by a developed country(ies) or multilateral organization(s), to implement development cooperation programmes and projects.'

The 24 May2018 *India-Netherlands Joint Statement*, declared during Dutch PM Mark Rutte's state visit to India, encourages the two countries to jointly promote a more widespread application of solar technology under the International Solar Alliance in third countries (Government of India and the Government of the Netherlands 2018). The 1 June2018 *India-Singapore Joint Statement* — drafted as an outcome of PM Modi's state visit to Singapore — situates digital connectivity and platforms, skills enhancement, human resource development and basic infrastructure as potential areas of bilateral cooperation between India and Singapore in third countries (Government of India and the Government of Singapore 2018). The 10 July 2018 *India and Republic of Korea: A Vision for People, Prosperity, Peace and Our Future* statement between New Delhi and Seoul also seeks to expand the existing strategic partnership to development cooperation in third countries, looking first at capacity building initiatives in Afghanistan (Government of India and the Government of the Republic of Korea 2018).

Since agreeing to cooperate with third countries to address global challenges such as health, education, water security, sanitation and availability of clean energy in a joint statement in June 2016 — India's triangular cooperation with the US has already attained global proportions in terms of development assistance, and has been impactful across states in Asia and Africa. Both countries support the *Feed the Future India Triangular Training Program*, which seeks to train personnel from the agriculture sector of participating countries such as Kenya, Liberia and Malawi in best practices to improve agricultural productivity and prevent losses. The training programs are held both in India and participating countries with the support of the US Agency for International Development (USAID) and the Indian Ministry of Agriculture. USAID also actively shares India's soil, water and dairy management practices with countries such as Kenya to give rise to sustainable food security. India's frugal innovations in agriculture technology — such as light tractors, seed dribblers and food processors — have also found their way to Kenyan farming sector through Indo-US triangular cooperation. Other Indian innovations — such as hybrid crop seeds — have benefited Nepal in its own quest for food security through Indo-US triangular cooperation. The two sides have also been jointly working on healthcare and women's empowerment in Afghanistan. Both sides also support the *South Asia Regional Initiative for Energy*

Integration (SARI/EI) — an initiative meant to enhance clean energy trade and cooperation in South Asia (USAID 2020).

The India-UK strategic partnership has a potent dimension to address global development issues. The Indian MEA and UK's Department for International Development (DFID) issued a *Statement of Intent on Partnership for Cooperation in Third Countries* in November 2015 — providing a formal framework for cooperation. However, the two sides had already been involved in projects such as *Supporting India's Trade Preferences for Africa* by March 2014 — an initiative funded by the DFID meant to enhance commercial engagement between India and African states with a focus on employment generation and rise in trade volume through greater access to the Indian market and transfer of Indian skills and technology to African states such as Ethiopia, Kenya, Rwanda and Tanzania. The India-UK triangular cooperation has also led to initiatives such as *The DFID–TERI Partnership for Clean Energy Access and Improved Policies for Sustainable Development* — meant to promote clean energy solutions in such basic aspects of daily life as lighting and cooking in Kenya and Ethiopia. *The Strategic Health and Nutrition Partnership (SHNP)* enables both countries to provide healthcare support to third countries. *The Global Knowledge Partnership Programme (KKP)* allows both countries to share the lessons learnt by India through its long development journey with personnel from participating countries. *The Global Research Partnership on Food and Nutrition Security, Health and Women (GRP)* seeks to address development issues such as food security, health and women empowerment through capacity building and provision of technology. *The Innovative Ventures and Technology for Development (INVENT)* program also aids low income-states of India and developing states in South Asia and Africa to develop innovative solutions for issues faced by the agriculture, healthcare, skill development, energy and education sectors of the participant entities (Mittal 2020: 6-9).

India also undertakes triangular development cooperation with its Asian strategic partner Japan. Both sides support the AAGC to promote industrial development of Asia and Africa. In Africa, Indo-Japanese triangular cooperation focuses on a business-to-business model *led by the private sector* inducing welcome foreign direct investment in participating states. Both countries are further involved in infrastructure building in Africa. This triangular cooperation in terms of the AAGC is guided by a will to enhance both individual and mutual

engagement with Africa, focusing on infrastructure — and to link African states with the Indian Ocean Region (IOR) in harmony with a joint vision for the Indo-Pacific that is based on a liberal and value oriented order in the international system (Mittal 2020: 9-10).

India further has triangular partnerships with multilateral organizations such as the United Nations Development Programme (UNDP) to address a common objective of *South-South Cooperation*. This cooperation has enabled India to share its experience in areas such as holding democratic elections with countries such as Nigeria, Egypt and the Philippines. India also interacts with its partners from the Global South by sharing experiences in crucial areas of development cooperation such as Millennium Development Goals (MDGs), sustainable development, healthcare, disaster mitigation and clean energy under the auspices of this triangular cooperation (UNDP India 2020).

In his address at the 74th Session of the United Nations General Assembly — delivered on 27 September 2019 — India's PM Narendra Modi announced in front of a gathering of world leaders that India under his administration had launched and implemented the worlds' biggest sanitation campaign; health insurance scheme; financial inclusion scheme; and digital identification program. Modi (2019b) further stressed India's commitment towards eliminating single-use plastic; ensuring water conservation and supply; building roads sustainable housing; and eradicating Tuberculosis (TB) by 2025 — ahead of the global deadline of 2030 in India. Modi stated that India's development values were not meant solely for its own people and emphasized that the fruits of India's development were meant for the entire world. Modi (2019b) reiterated his resolve to develop India at a faster pace so that its counterparts in the developing world can benefit from the country's experience.

Modi (2019b) further remarked that: 'The issues that India raises, the kind of new global platforms that India has come forward to build, seek collective efforts to address serious global challenges and issues.' Modi reiterated his initiative of building the *International Solar Alliance* — which seeks to promote solar power as a mainstream source of energy. Modi (2019b) further reiterated his commitment towards *Coalition for Disaster Resilient Infrastructure* (CDRI) — meant to collectively give rise to infrastructure largely immune to perceivable natural disasters. Modi further observed that 'modern technology in the 21st Century, is bringing about sweeping changes in social life, personal life, economy, security,

connectivity and international relations' — and contended that the international community 'will have to give new direction and energy to multilateralism, and to the United Nations.'

India participates in ongoing global nuclear research through its national institutions such as Bhabha Atomic Research Centre (BARC) — which contribute data for addressing global challenges such as reaching common benchmarking standards for metallic components under massive seismic pressure under the Organisation for Economic Co-operation and Development (OECD)'s Nuclear Energy Agency. India also provides its hardware for global civilian nuclear research programs, such as gas detection equipment built at Variable Energy Cyclotron Centre (VECC) in 2015 meant for the Compressed Baryonic Matter (CBM) experiment in Germany. Beyond the provision of data and hardware, New Delhi also trains foreign scientists and technicians in civilian nuclear technology — either under the ambit of the IAEA or its bilateral/multilateral commitments — in its own training facilities. As a part of the IAEA's Board of Governors, India has further provided input to shape the body's international policy, and has deputed experts from its own pool of nuclear specialists on foreign assignments both under the ambit of the IAEA and under its other bilateral and multilateral obligations (Sikka 2017: 42-44).

To address climate change as a state, India's Ministry of Environment, Forest and Climate Change (MoEFCC) serves as the nodal body for implementing its multilateral commitments — including those under the ambit of the United Nations Environment Programme (UNEP) and the International Centre for Integrated Mountain Development (ICIMOD). India's MoEFCC also coordinates with multilateral fora such as the United Nations Convention to Combat Desertification (UNCCD); the United Nations Framework Convention on Climate Change (UNFCCC); and Convention on Biological Diversity (CBD) for discharging its duties to address global environmental conservation and climate change. India further provides both human and financial resources to the UNEP to aid its agenda of developing sustainable and practical environmental solutions for governments, private sector and society. India is a founding member of the Global Environment Facility (GEF) since its inception in 1991 and contributes to the achievement of Sustainable Development Goals (SDGs) adopted by the United Nations General Assembly (UNGA) 2015, in which both the country's MEA and MoEFCC provided input (Sikka 2017: 45-47).

As a state, India enjoys a unique geography with proximity to the Earth's equator — and this has partially resulted in the country taking a stand to announce the initiative of the *International Solar Alliance* (ISA) in partnership with its longstanding strategic partner France during the Paris Climate Summit in 2015. The ISA seeks to mainstream the use of solar energy and has the membership of over ten dozen states situated between the Tropic of Cancer and the Tropic of Capricorn. Since January 2016, the ISA is headquartered at Gurugram, India — and further enjoys the confidence of the World Bank for mobilizing One Trillion USD for global solar energy investments by 2030. As a part of the ISA Framework Agreement signed in November 2016, India has agreed to support the ISA Secretariat for five years since 2016 and then leave the options open for consideration by member states. The ISA also coordinates with international agencies for seeking solar energy as a practical utilitarian alternative to conventional energy sources (Balakrishnan 2017: 213-216).

However, India's commitments to addressing climate change — an issue of global concern — may impinge upon its own national objective of using its available resources for reaching rapid growth to transition from a developing rising power to a developed great power. Given India's massive energy requirements, its future carbon footprint can increase in the full view of the international community despite New Delhi's sincere counter-measures to contain the same — and the country faces real threats in adhering to its stated climate change obligations given its low levels of energy efficiency and high levels of dependence on fossil fuel. To situate things, India — by 2014 — had relied on renewable energy to fuel less than 30 percent of its overall energy requirements and given the high costs of transition from carbon-based fuel to its cleaner alternatives amidst the existence of a significant rural population, New Delhi might see the limits of its state power tested to meet the challenge to provide energy and power to its citizens while also adhering to stringent climate change obligations as an international commitment (Mallik 2016: 196-199).

India's approach to address global food security is also marked with both multilateral and bilateral engagement. India's Department of Agriculture, Cooperation & Farmers Welfare is a signatory to the UN World Food Programme's (WFP) Country Strategic Plan and the country further monitors the World Food Summit (WFS) Plan of Action as a member of Food and Agriculture Organization's (FAO) Committee on World Food Security. India has also

played a part in establishing the more immediate response mechanisms to address food insecurity, such as the SAARC Food Bank — a South Asian reserve of food grains to which India contributed over 60 percent of the overall share by 2017. India is a member of the International Grains Council (IGC) and is a signatory to both the 1995 International Grains Agreement (IGA) and 1995 Grain Trade Convention (GTC). In IGC, India has been contributing as an exporting member of the body since 2003 (Sikka 2017: 47-49).

India has also contributed to the study of the Earth System jointly mitigate natural disasters and address environmental conservation with its partners in the international system. India is an observer state in the Arctic Council and carries out extensive polar research through its permanent research stations — such as *Maitri* and *Bharati* in the Antarctic, and *Himadri* in the Arctic. The country participated in the first *International Indian Ocean Expedition* (IIoE) between 1962 to 1965 and further took a conclusive lead in the second version of the IIoE — which is ongoing since 2015 — by undertaking nine endorsed projects for marine research in the Indian Ocean Region (IOR), ahead of the US and Australia, which had seven and six endorsed projects in the expedition by 25 December 2019 respectively. On the bilateral side, India signed six Memorandums of Understanding with the US, China, Germany, Switzerland, Qatar and Bangladesh for cooperation in marine research between 2015 and 2016 (Sikka 2017: 50-51; The Second International Indian Ocean Expedition 2019). India also coordinates with other states in the international system for disaster prevention and management under the ambit of mechanisms such as *Regional Integrated Multi-Hazard Early Warning System for Africa and Asia* (RIMES), which the country chaired in 2019 (Regional Integrated Multi-Hazard Early Warning System for Africa and Asia 2019).

Through the COVID-19 pandemic, India emerged as an early respondent in Asia first by sending a consignment worth 15 tons of critical medical supplies to its geopolitical rival China on 26 February 2020 — which also included protective medical equipment such as masks and gloves. India then activated the SAARC mechanism for addressing common challenges on 13 March2020 — which it had long forsaken in the face of provocations from Pakistan — to allocate 10 million USD to a newly created *SAARC COVID-19 Emergency Fund* on 15 March 2020, an initiative that was not only welcomed notionally but was also

financially supported by the members of the South Asian regional grouping (Balakrishnan 2020: 8).

Commenting on India's role to answer the global challenge posed by COVID-19, Balakrishnan (2020: 8) states that 'India has sent 85 million hydroxychloroquine tablets and 500 million paracetamol tablets to 108 countries. In addition, 1 thousand tons of mixture have also been sent to make paracetamol tablets.' Pant and Mann (2020) note that 'India has also organised e-ITEC training programmes for healthcare professionals under the aegis of the country's reputed medical colleges like the All India Institute of Medical Sciences (AIIMS) in Delhi and the Post-Graduate Institute of Medical Education and Research (PGI) in Chandigarh.'

The Government of India's global response to the COVID-19 pandemic, despite its own internal challenges as a developing state answerable to 1.3 billion people, aligned well with its existing foreign policy calculations. In the Indian Ocean Region (IOR), New Delhi sought to pursue its *Indo-Pacific* strategy by aiding not only its existing strategic partners, but also states with which India had seen a deterioration of ties by 2020. India's evacuation operations saw citizens from IOR states such as Bangladesh, Myanmar, Maldives, South Africa and Madagascar being also evacuated, quarantined and treated in India before being sent to their home countries. India emerged as the first global responder to IOR states, such as Mauritius and the Seychelles, for the supply of life-saving medical aid amidst the COVID-19 pandemic. India also sent wheat supplies to its strategic partner Afghanistan via Iran's Chabahar port and agreed to supply anti-malaria medicine to Malaysia. Like Malaysia, Iran too was a critic of India's internal religious turmoil but also sought the aid from the South Asian giant to combat the pandemic (Marjani 2020).

Beyond the *Neighborhood First* and the *Indo-Pacific* strategies, the Indian response to COVID-19 pandemic also covered the gulf region and western Asia — a strategic foreign policy priority since the advent of the first Narendra Modi administration in 2014. Following a telephonic conversation with Sheikh Sabah Al-Khaled Al-Hamad Al-Sabah of Kuwait on 1 April 2020, Indian PM Narendra Modi dispatched a team of 15 healthcare professionals to assist Kuwait in its efforts against the novel virus. India also sent a dispatch of Hydroxychloroquine (HCQ) to Gulf states such as Jordan and Oman. New Delhi further responded positively to Israel's request made through its PM Benjamin Netanyahu in mid-

March for medical aid by sending five tonnes of medicine to the West Asian state by April 2020. India also evacuated over 500 Israeli citizens between 26-27 March through its state carrier Air India for repatriation to Israel (Ningthoujam 2020).

Noting the efficacy of India's medical response during the COVID-19 pandemic, Indian Minister of State for External Affairs V. Muraleedharan — in his address to the webinar *Revisiting Economic Cooperation in BIMSTEC in Post-Covid 19 Era* held on 30 June 2020 — situated the pandemic as the 'single greatest shock to the international system since World War II' and India as the 'pharmacy of the world', which was able to deliver large quantities of essential medicine and critical expertise in healthcare to its partners in the international system (Muraleedharan 2020).

By October 2020 — India, Australia and Japan had agreed in principle to device a supply chain resilience initiative that would help provide an alternative for the Indo-Pacific region enabling states to avoid undue dependence for trade and essential commodities on an increasingly aggressive China (Rajagopalan 2020). The 27 October2020 *Joint Statement on the Third India-U.S. 2+2 Ministerial Dialogue* confirmed that the Defence and External Affairs representatives of both India and the US 'reaffirmed efforts to enhance supply chain resilience and to seek alternatives to the current paradigm, which had come under severe strain during the pandemic and exposed critical vulnerabilities' in a bid to enable the recovery of the international economy from the shock of the COVID-19 pandemic (Government of India and the Government of the United States of America 2020).

The *Quad Leaders' Joint Statement: The Spirit of the Quad* — delivered by the Government of Australia, Government of India, Government of Japan and the Government of the United States of America (2021) on 12 March 2021 — envisions a free, open and secure Indo-Pacific region with an emphasis on responding to shared COVID-19, climate change, development, HADR and security challenges. The statement takes cognizance of the dire nature of the ongoing COVID-19 pandemic — and goes on to profess a collective will towards securing safe, effective and equitable vaccine production, distribution and access to those who require it the most. The Ministry of External Affairs, Government of India (2021) — as of 6 April 2021 — confirmed that India had dispatched a net total of 64.502 million vaccines to 84 states in

the international system under grant, commercial and COVAX umbrellas combined.[53] As noted in the sections above, India's external COVID-19 relief efforts have been led by its private sector.

S&T-based Development Cooperation and Domestic Dynamics in the Indian Environment

On 26 May 2008 — during the dedication ceremony on land for the South Asian University — India's EAM Pranab Mukherjee recalled that the country had resolved to host the university since first making commitment for it at the 13th SAARC Summit in Dhaka, Bangladesh held between 12-13 November2005. Mukherjee (2008) situated the 21st Century as the century of the knowledge economy and hoped that the students of the university, hailing from across South Asia, will not only gain quality higher education but will do so in a spirit of 'fraternity and friendship'.

Mukherjee (2008) saw the allocation for land for the South Asian University as being among the 'first manifestations of concrete SAARC achievement on the ground' and noted the quickness with which SAARC member states had agreed to the establishment of the university in New Delhi, India during the 14th SAARC Summit held in April 2007. Mukherjee hoped to 'witness the University's first academic session in 2010' and further sought to host approximately 5000 students and an international faculty with campuses linked to institutions of higher-education throughout SAARC member states in 'the very near future.'

The groundbreaking ceremony of the South Asian University was held in New Delhi on 3 June 2015, seven years after EAM Mukherjee spoke on the dedication ceremony on land. In the ceremony, Sushma Swaraj — the incumbent Indian EAM at the time — recalled the high ideals with which India offered to host the university during the 13th SAARC Summit in Dhaka, including the objective to 'establish a university dedicated to the region with world-class facilities'.

[53] Refer to Appendix 4 for details.

Swaraj (2015) situated South Asian University as 'the first international university in India' and reiterated New Delhi's commitment to bearing all capital costs for establishing the university. EAM Swaraj also thought of the university as moving 'in the right direction with state-of-the-art infrastructure, dynamic curricula and a globally-recruited faculty'.

However, by June 2016 the university promised by India to support world class facilities for South Asia had yet to achieve even basic amenities. India's own labyrinthine land and construction approval laws had delayed the inception of a new campus, on which construction commenced only in May 2016. In the meantime, India had to provide classrooms at the country's Jawaharlal Nehru University and hostel accommodations at the Centaur Hotel in New Delhi. At one time, India shifted the university entirely to Akbar Bhavan — a former luxury hotel during the 1980s now under the union government — in New Delhi (Mitra 2016a).

The allocation of land by the Delhi Development Authority (DDA) for the construction of the university had run into legal contestation and litigation and the environmental approval came only on 3 June 2015, on the very same day when EAM Swaraj appeared for the ground breaking ceremony. With the construction of the university under distress, the SAU also had to scale back on the expansion of both its academic curriculum and student intake given the limited space at the temporary campus at Akbar Bhavan (Mitra 2016a).

Hosting a university for South Asian students also brought other complications, such as visa issues for students originating from Pakistan and Bangladesh, which adversely impacted research efforts of students from affected countries. Challenges also emanated from the external environment, with states such as Pakistan shying away from disbursing their annual financial contributions to the university (Mitra 2016a).

A similar theme would emerge with India's commitment to establish a modern version of its ancient Nalanda University which — along with other ancient universities such as Taxila and Vikramshila — became a symbol of India's civilizational history. On 15 January 2007, the Chairman’s Statement of the Second East Asia Summit (EAS) held at Cebu, Philippines stated that EAS had 'agreed to strengthen regional educational cooperation, noting that we could tap the region’s centers of excellence in education for this purpose. Noting proposals to

renew our historical ties, we welcomed initiatives such as the revival of the Nalanda University in India, to improve regional understanding and the appreciation of one another's heritage and history' (East Asia Summit 2007).

In her address at the inauguration of Nalanda University — on 20 September 2014 — the Indian EAM Sushma Swaraj envisioned Nalanda University as not only a 'link between the past and the present' but also 'the bridge to our future' vital to India's Look East Policy. Swaraj (2014) saw the revival of the Nalanda University as being capable of reviving connectivity between India and other Asian states. Swaraj remarked that 'this university will be a centre of excellence with a contemporary relevance devoted to cutting edge research that is networked to leading institutions' and further noted Indian provision of finance to the university and scholarships to students from Cambodia, Laos, Myanmar and Vietnam. Swaraj also noted that the university was 'operating out of temporary premises with a small group of students and faculty and have made a beginning with only two of the envisaged seven schools' and called upon the management to realize its full objectives in the right earnest.

Despite the availability of land, Nalanda University's construction of a permanent campus also met with delays — in this case due to procedural issues arising out of a controversial tendering and negotiation process in 2015, which was flagged by the Indian MEA's finance division. This was after the original plans to begin construction by January 2012 had themselves suffered delays leading to a further delay in tendering process (Mitra 2016b).

The construction of the Nalanda University also exposed the lack of coordination between the Indian parliament, the MEA and the university. Furthermore, the Government of India had also taken until 2014 to sanction the bulk of the funding for the project. As an outcome, the university could support only 60 students in a make-shift campus by May 2016. Nalanda University also had only two functional schools by May 2016, the same number since Swaraj (2014) delivered her inauguration address hoping for speedy progress (Mitra 2016b).

India's domestic dynamics also have a bearing on its more ambitious outbound development cooperation commitments. On 17 May 2015 — in his address to the Mongolian parliament in Ulan Bator — Indian PM Narendra Modi invoked the friendly history between the two countries and went on to suggest further cooperation in areas such as cyber-security,

farming and healthcare. The Indian PM stated his commitment towards expanding and upgrading the *Atal Bihari Vajpayee Centre for Excellence in Information and Communication Technology* in Mongolia. Modi (2015b) also promised to increase ITEC slots to Mongolia and gifted Bhabhatron radiotherapy equipment for aiding Ulan Bator's efforts against cancer.

Modi stated that he had conveyed to Mongolian Prime Minister Chimediin Saikhanbileg, the 'decision to provide one billion U.S. dollars Line of Credit to develop institutions, infrastructure and human resources in Mongolia.' Edwards (2015), while writing for the *Reuters UK*, noted the extension of the Indian Line of Credit to Mongolia. Edwards noted that Mongolian economy had been struggling by the time of Modi's arrival due to the weakening of the Chinese coal market and that Ulan Bator sought to utilize Indian Line of Credit for developing the country's railway network. Edwards further noted the Indian intention of developing closer economic relations with Mongolia through Modi's visit.

While the foreign policy implications of PM Modi's visit to Mongolia and India's extension of one billion USD line of credit may have been understood within the IR community, the Indian domestic political environment took to the events in an altogether different line. The Aam Aadmi Party (AAP) — which held government in the *Delhi union territory* at the time — sought to address a strike of sanitation workers over pending payment of salaries by blaming the Bharatiya Janata Party (BJP), its rival political grouping and the party of PM Modi. Dilip Pandey — the convener of AAP in Delhi union territory — stated that 'the prime minister has spent thousands of crores for Mongolia but it seems he doesn’t have money for sanitation workers of Mangolpuri' (The Indian Express 2015).

The Indian National Congress (INC) — India's main opposition party since 2014 — also sought to question the decision of extending a one billion USD Line of Credit to Mongolia, and even went on to question the utility of the Indian Prime Minister's foreign visits. The INC spokesman Raj Babbar hypothesized that the PM 'has given funds to Mongolia from the earning of the state exchequer of the UPA period. This government has hardly been able to generate resources till now'. Opposition also came from other political parties *within India's states* such as Shiv Sena, which questioned the wisdom of allotting funds to Mongolia while farmers in the Indian state of Maharashtra faced starvation (Firstpost 2015).

India's domestic dynamics also influence the country's inbound development assistance meant for advancing its scientific and technological progress. During the 2015 India-Japan Summit, Japanese Prime Minister Shinzo Abe agreed to assist India in the construction of a rail project between Mumbai and Ahmedabad modeled along the lines of Japan's highly-advanced *Shinkansen* system. Tokyo's assistance to its strategic partner New Delhi in building a state-of-the-art transport system also came with generous financial support, with Japan providing the funds at less than 1% interest rate per annum (Sentaku Magazine 2018).

However, this Indo-Japanese rail project fell victim to India's complex land acquisition realities, which led to change in plans by enhancement of the area to be covered by elevated railroad. Since land acquisition is a politically sensitive issue in India, the amount of overground railroad quickly gave way to desire for more elevated construction, with a potential for an increase of costs for Japan. Furthermore, 2023 — the initial proposed date for operationalizing the Mumbai-Ahmedabad rail project[54]— looked increasingly uncertain by 2018 due additional complications from the Indian side (Sentaku Magazine 2018).

In November 2018, Japanese PM Shinzo Abe reiterated his commitment to the Mumbai-Ahmedabad rail project in India. The Press Trust of India (2018) noted that 'Japan is funding 80 per cent of the Mumbai-Ahmedabad bullet train project through a soft loan of Rs 79,000 crore at an interest rate of 0.1 per cent, with a tenure stretching over 50 years and a moratorium period of 15 years.' PM Abe himself situated the *Shinkansen* as having played a role in Japan's economy and development, and sought to translate the success of the project to India in a *shining symbol of Japan-India friendship*. The Indian National High Speed Rail Corporation also sought to meet the project deadline of 2022, ahead of the initial deadline of 2023 (The Press Trust of India 2018).

Despite Japanese commitment, opposition to the Mumbai-Ahmedabad rail project came in 2019 from Shiv Sena — BJP's former ally turned adversary in the aftermath of the 2019 Maharashtra Legislative Assembly elections. After Shiv Sena's rise to power in the

[54] According to *Japan-India Relations (Basic Data),* held by the Ministry of Foreign Affairs, Government of Japan (2019): 'India decided to introduce the Shinkansen system in December 2015, when Prime Minister Abe visited India. The Japan's Shinkansen system is in a highest class of High-Speed Railway systems around the world in terms of its safety and accuracy. Japan and India confirmed that the General Consultant would start its work in December 2016, the construction work would begin in 2018, and the railway's operation would commence in 2023.'

Maharashtra state, its leader Deepak Kesarkar questioned the utility of the project and stated that 'farmers, workers, women, youth' were the priority of the new state government in Maharashtra instead of the Mumbai-Ahmedabad rail project, which Kesarkar felt was rendered redundant in the era of air travel (Press Trust of India 2019).

The Mumbai-Ahmedabad rail project is not the only case where India's development engagement with Japan would face uncertainty due to the country's volatile domestic politics. In December 2019, Japanese PM Shinzo Abe had to postpone his state visit to India, which was to be held in the Indian city of Guwahati — the capital of the country's northeastern state of Assam — due to security and logistical concerns emanating from ongoing mass protests against a newly passed *Citizen Amendment Bill*. India and Japan had previously agreed to hold the Modi-Abe summit in Guwahati instead of New Delhi to lay emphasis on cooperation in India's *Act East* policy through the *India-Japan Act East Forum* — established in 2017 to support connectivity, infrastructure, industrial and cultural projects in a bid to develop India's northeastern states. Both sides chose to not move the venue to New Delhi away from Guwahati since the message of joint commitment to development cooperation in India's northeast states stood to be diluted in the process. Tangible announcements regarding Indo-Japanese cooperation in India's northeast were expected during the summit (Siddiqui 2019).

Given contestation between various political groupings, electoral politics continues to impact S&T Diplomacy in India at the state level. The example of the country's most populous state Uttar Pradesh to make this case is worth mentioning in this regard. During the run-up to the 2019 Indian general elections, the small hamlet of Amethi — previously a safe electoral bastion of BJP's chief national rival INC — was addressed by the country's incumbent PM Narendra Modi, who is also a Member of Parliament from the BJP. Modi asserted that the modernization of India's defense technology was neglected by the previous administrations and then announced his approval for manufacturing *AK-203* assault rifles in the same parliamentary constituency in the state of Uttar Pradesh in collaboration with Moscow (The Indian Express 2019).

By late November 2021, India Today (2021) stated that 'ahead of the Uttar Pradesh Assembly elections scheduled for next year, Amethi is set to emerge as a hub for the manufacturing of

AK203 assault rifles' and that — given a clearance by the Indian Ministry of Defence and the country's Defence Acquisition Council — the decision to manufacture AK-203 to the tune of over six hundred thousand at the installation at Amethi stood approved, also including transfer of Russian assault rifle technology to India. This case can safely be constructed as one that included not only the country's national interests but also involved national and state electoral politics.

However, given India's federal structure the writ of New Delhi ultimately does not reign unchallenged in the country's states. PM Modi's June 2020 move to auction coal blocks for commercial mining came under contestation given clean energy technology concerns from not only the Mamata Banerjee led government in West Bengal but also from Jharkhand state government, which sought intervention of the Supreme Court of the country to impede the process (Gupta 2020).

There are other, more understandable, examples of India's S&T calculations being mired by its domestic dynamics. Following a series of prolonged and deadly Sino-Indian border skirmishes since May 2020, Indian public sentiment — already sour given Beijing's shoddy response to the COVID-19 pandemic — turned decisively against its Asian rival China, leading to calls for decoupling of commercial links between the two economies. New Delhi responded to Beijing's military provocations by blocking 59 software applications of Chinese origin in India, citing concerns of 'sovereignty, integrity and national security' by 29 June 2020. This ban came within weeks of Indian Railways previously terminating a multi-billion INR project of Chinese origin for signaling operations and India's state-owned telecom companies being ordered not to avail Chinese products for their 4G upgrade operations (Pant 2020).

By 2000, AS Rao — of the Department of Scientific and Industrial Research, Ministry of Science and Technology, Government of India — stressed that, given the advent of market reforms in the Indian economy, the fundamentals of developing absorption capacity had to lie before the actual acquisition of technology for successful internalization. In this regard, Rao identified that Indian firms were yet to devote attention to building design capabilities despite their efforts for reaching sheer levels of manufacturing capability. Rao opined that India's emphasis on import substitution had endured through its economic reforms partially

due to the yet expensive nature of acquiring technology from abroad and also due to obsolete technology being still accepted in much of India (Rao 2000: 110-111).

Enduring issues of procurement, production and R&D have hampered some of India's core national interests in the 21st Century — the foremost being the defence sector, critical for the country's national security. India, even as a rising power, has a lackluster defence R&D base that is led by its government-owned Public Sector Undertakings (PSUs) — most prominently by the Defence Research and Development Organisation (DRDO) — which has proven to be inefficient in provision for the country's defensive capabilities despite the rise of the *Make in India* initiative under the first Narendra Modi administration. The *lack of private sector participation* further exacerbates the already dire conditions which plague defence modernization in India. Furthermore, India still suffers from a lack of policy consensus in the defence areas where Foreign Direct Investment (FDI) would be welcomed (Behera 2018: 194-195).

In its *Demands for Grants (2018-19). Army, Navy and Air Force (Demand No. 20), Forty First Report* — The Standing Committee on Defence, Lok Sabha (2018) noted the systemic changes in the *Defence Procurement Procedure of 2016* and welcomed the *Make in India* initiative but also noted the lack of budget allocations for supporting these changes. The committee further noted that despite the provision of foreign firms to partner with Indian companies for manufacturing defence equipment in India, the vision could not be realized due to budget difficulties. Financial constraints — according to the committee — impeded India's quest for indigenization in the defence sector.

Lele (2019b) notes that 21st Century India is still not in a position to *internally* develop many core technologies and relies on *external* powers for cooperation, and thus itself faces challenges in technology transfer and collaboration given the transactional nature of donor-recipient relationship. Nagao (2019) asserted that 'to use technology as a card of diplomacy, India needs the card itself. In this case, the card is technological development itself.' Nagao states that — barring some exceptions — India remains a state without much significant innovation in advanced technology. Nagao stated that if India advances the development of technology than it can emerge as a more credible source of S&T in the international system.

Nagao (2019) further asserted that a healthy research budget and an awareness in politicians and bureaucrats of India regarding S&T are important factors that can enable the rising power to realize its potential in the domain of S&T Diplomacy. Nagao stated that India's government and private sector need to realize the financial and reputational value of S&T — and devote not only finance but time to develop technology.

India's designs to emerge as a net provider of security during the ongoing COVID-19 crisis may also be impacted by its domestic dynamics. By the time this thesis was written, India had emerged as a major global provider of vaccines meant to fortify human beings against the novel coronavirus — including a significant commitment to WHO's COVAX programme, which seeks to provide 2 billion vaccine doses to people from low and middle-income states in the international system by the end of 2021. However, the country's private sector pharmaceutical enterprises — such as the *Serum Institute of India* — have increasingly had to balance medical needs of the country's own population with foreign priorities, making an ideal adherence to WHO timelines untenable (Kay and Amin 2021). The extent to which India can respond internationally to the COVID-19 crisis amidst pressing need to vaccinate its own population has yet to emerge fully for a final assessment.

Then there are questions regarding the role of India's S&T-enabled diaspora in the country's development. Nagao (2019) stressed on the need for India to create a network of scientists from across its diaspora. Nagao (2019) also stressed that India's own S&T professionals should develop language skills to access S&T content available in other technologically advanced states such as Japan.

India's incumbent EAM Jaishankar (2021) linked the country's ongoing *Atmanirbhar Bharat* approach — meant to ensure greater self-reliance for the Rising Power in a turbulent international system — to a more robust engagement with a diaspora outside its geographical confines amidst the ongoing COVID-19 pandemic. Muraleedharan (2022) stated satisfaction on the S&T-orientation of Indian diaspora, tentatively connecting Indian ethos with STEM advances made by the country's diaspora in the international system. Muraleedharan also noted the prominence of the Indian diaspora in the international STEM ecosystem. Muraleedharan noted that 'India is among the very few countries which has an

extensive and evolving policy framework for engagement with diaspora'. The incumbent Indian MoS (External Affairs) noted the need to engage with the younger demographic segment of the country's diaspora to address the country's emerging national needs at least partially.

Whilst the efficacy of the GoI's measures to attract talent from its S&T-inclined diaspora back to the country yet remains to be fully situated, New Delhi also seems keen on celebrating the diaspora's progress through its exalted state felicitations. In this regard, Satya Nadella and Sundar Pichai — the Indian-origin incumbent and respective Chief Executive Officers of Microsoft and Alphabet now based in the US — received the *Padma Bhushan* civilian awards for their achievements outside of the country's geographical confines by the second Narendra Modi administration in 2022. Private sector leaders of *Serum Institute of India* and *Bharat Biotech* — namely Cyrus Poonawalla, and Krishna Ella & Suchitra Ella respectively — were also conferred the same third-highest civilian award by India in 2022 for their role in developing vaccines meant to counter the ongoing COVID-19 pandemic (Gunasekar and Bhasin 2022).

Chapter Summary

India has employed S&T Diplomacy in practice as a part of its development cooperation design since the country's independence — much before the formal theoretical tenets of the concept fully emerged in the recent decades for discussion and debate. Since independence, India's role as *both* a donor and a recipient of S&T and development assistance has also been constant in varying degrees. However, during the 20th Century the country was largely a recipient of development assistance although it ran a cost-effective, S&T-led development cooperation programme of its own which was impactful in the Global South despite New Delhi's limited resources. As a rising power, 21st Century India relies primarily on a select group of multilateral organizations and strategic partners to aid its own S&T and development needs. New Delhi has also emerged as a significant donor in the international system in its own right in the 21st Century — and one which pursues bilateral, triangular

and multilateral mechanisms to increase the impact of its outbound development assistance, which is led by the S&T component. A representative example of India having emerged as a major provider of development assistance in the 21st Century remains New Delhi's 2019 extension of a one billion USD LoC to Moscow, which was an erstwhile principle source of Indian technology during and well-after the Soviet era.

Time-tested components of India's S&T Diplomacy such as the ITEC programme have endured through the decades and more recently new ideas — such as Small Development Projects (SDP) — have also emerged in the country's development assistance/cooperation strategy. New Indian initiatives such as the International Solar Alliance (ISA) and Coalition for Disaster Resilient Infrastructure (CDRI) have been met with positive global response. The country's development cooperation programme enjoys institutional backing from its MEA, which houses four Development Partnership Administration (DPA) divisions to oversee progress. The Indian MEA hosts a New Emerging & Strategic Technologies division for responding to change in the global S&T landscape. New Delhi also hosts a States Division within the country's MEA for addressing the concerns of states in foreign policy.

India's development cooperation strategy is visibly guided by the core essentials of its foreign policy such as its *Neighbourhood First*, *Act East*, *Think West*, *Indo-Pacific*, *South-South Cooperation* and pro-Africa policies. These aspects and the existence of a vast industrial base have enabled the country to emerge as a major international responder to global shocks such as the ongoing COVID-19 pandemic, aiding its partners in the international system through times of crises.

However, India's attempts to gain access to multilateral export control regimes such as the NSG have met with resistance from its Asian rival China, with which its relations have further deteriorated given recent border tensions. Also, a labyrinthine web of regulations in critical areas such as land acquisition makes implementing foreign-backed development projects on India's own soil difficult while New Delhi's development projects outside its borders often lack the required focus for a timely completion. Furthermore, India's political class may not always appreciate the consequences of its domestic politics on the country's international relations. A critical assessment of India's S&T Diplomacy as an instrument of foreign policy

in the 21st Century is undertaken in Chapter 5 of this study, in which these issues are addressed in greater detail.

Chapter 4: Beyond Stars: Space Diplomacy in Service of India's Foreign Policy Objectives in the 21st Century

This chapter examines the role of Space Diplomacy in Indian foreign policy in the 21st Century. The chapter begins by orienting the reader with the rise of the Indian space programme. The chapter then goes on to provide details of India's diplomacy for space technology. India's Space Diplomacy for advancing its foreign policy interests and for meeting the demands of the international system whilst securing its national interests is then analyzed. The relationship between space technology and domestic dynamics in India is further explored in this chapter.[55]

Rise of the Indian Space Programme

Prior to the onset of the 20th Century, the study of space and research and development activities entailed within were not necessarily in the domain of nation-states but rather depended upon the efforts made by individuals engaged in the field. However, as more states attained sovereignty in the 20th Century more governments actively sought to cultivate expertise in the domain of space sciences for their national development and defence. By the 1990s, the study of the outer space — and of earth itself — became increasingly vital to the interests of nation-states due to its wide-ranging implications (Daniel 1992: 485).

Indians have pursued scientific astronomy since the 5th Century and the country also had initial advantages in its early pursuit of space science as a newly independent nation-state. Early organized Indian efforts to study space correlated with scientific pursuits made by two of its most visionary scientist-administrators, namely Homi J. Bhabha and Vikram Sarabhai. Bhabha had set up the Tata Institute of Fundamental Research, Mumbai in 1945 and Sarabhai had set up the Physical Research Laboratory in Ahmedabad in 1947. Both these institutions

[55] Balakrishnan (2017: 292-294); Sharma and Varshney (2019: 11-12); Ministry of Science and Technology, Government of India (2013); Department of Science and Technology, Government of India (2019b); Swaraj (2019); and the Ministry of Science and Technology, Government of India (2020: 47-51) inform the building of the categories for this chapter.

played a vital role in the development of nascent space sciences in India (Daniel 1992: 485-487).

Other institutions in India contributed to the study of space science and the mainstreaming of the discipline in India after independence. The Research Department of All India Radio discovered reflections from meteor trails in one of the earliest instances of such an observation in the world. The Colaba Observatory situated in Mumbai — established in 1823 — provided the state with a rich reservoir of data on correlation on the ionosphere and the solar-terrestrial equation. The Indian Meteorological Department collected data using both ground-stations and balloon-borne scientific equipment to study research areas of national interest such as the Indian monsoon (Daniel 1992: 488).

Mistry (1998) envisaged the Indian space programme to have been built upon two stages of development. The first stage was devoted to acquisition of basic infrastructure and the second stage was devoted to developing space systems of a more credible capability. According to Mistry, the first stage of the development of the Indian space programme began in the 1960s when Indian scientists and administrators devised competent administrative protocols and rocket launching systems for national progress. The Indian National Committee for Space Research (INCOSPAR) was established as a part of the country's Department of Atomic Energy (DAE) in 1962 and evolved into the Indian Space Research Organization (ISRO), established in 1969 under the chairmanship of Vikram Sarabhai. Furthermore, India had a Department of Space in 1972. Despite financial constraints facing a new country, Sarabhai managed to compel the Indian leadership for finding resources to fund the Indian space program. India provided its Thumba rocket launching range to the US, France, Russia and the UK for launching hundreds of sounding rockets between 1963 and 1975, gaining familiarity with minute operational details in the process. Later, Indian scientists would focus on constructing and developing launch vehicles and satellites during the 1970s and the 1980s. The second stage of development, as per Mistry, was found in the mid-1980s when India developed its own signature launching systems such as the Polar Satellite Launch Vehicle (PSLV) and satellite systems such as the Indian National Satellite (INSAT). These advances would pave the way for India joining the ranks of foremost space-faring states for years to come (Mistry 1998: 151-153).

Since the 1960s, India's space programme was initially sought to play a key role in the development of the country by enabling the state to deliver services such as natural resource surveys, meteorology and educational broadcasts. However, the country's political class showed a keen awareness of the element of *prestige* that an advanced space programme granted to India in the international system, particularly among the non-aligned states. Indian space programme in the second-half of the 20th Century was also guided by the notion of self-reliance to minimize the bargaining power of potential partners and suppliers of space technology in the international system. India's space programme would further be influenced by the external environment, such as the hostility displayed by US and China during the 1971 Bangladesh Liberation War. After the 1971 war, India detached ISRO from the Atomic Energy Commission and placed it under the Department of Space, also assigning rigorous schedules to meet objectives in the domain of space technology amidst growing acknowledgement of the military potential of its space program. ISRO Director Satish Dhawan, in July 1974, stated before a central parliamentary committee that India had the capability to develop medium range missiles with indigenous solid fuel and guidance systems (Mistry 1998: 161-163).

That India continued to attach high-importance to its space programme was evident by the fact that ISRO's budget had doubled between 1967 and 1970, had doubled again between 1970 and 1972, and had almost doubled between 1972 to the end of 1974. ISRO also commanded a formidable team of over 8000 skilled personnel by 1975. However, ISRO still sought US assistance in broadcasting programs related to India's national objectives such as agriculture, health and family planning by 1975 (Science News 1975: 271).

Indian scientist SK Shrivastava — in his broadcast on All India Radio on 15 July 1975 — noted that contemporary space age saw a departure from prestige based missions of the past to missions that yielded high practical and utilitarian value in areas such as communication, meteorology and survey of earth's resources (p. 1-2). Shrivastava (1975: 1-2) stated that satellite technology had led to demonstrable advances in areas such as weather forecasting, which had consequent impact on critical areas of national importance such as air-travel, maritime navigation, agriculture and prevention of natural disasters — and this had already resulted in saving of human lives and property.

Shrivastava (1975: 1-3) also noted the criticism accorded to the Indian space programme given its high costs but concluded that a state such as India — with a vast geography and high population — stood to ultimately benefit through a cost-effective space programme since conventional methods to address national development issues were more time-consuming and less effective.

The early years of ISRO saw administrators such as Vikram Sarabhai staying firmly committed to the civilian ethos of the Indian space programme and firmly opposed to the development of dual-use technology — which could have military applications for the country (Mistry 1998: 156-157). ISRO, being aware of the constraints of the external environment, also did not adhere to an unrealistic scheduling program thereby allowing the indigenous production to proceed at a practical pace. Following the Smiling Buddha nuclear tests of 1974, India had cautiously embarked on an indigenous supply ecosystem for its space and missile programs to lessen its national reliance on foreign collaboration (Mistry 1998: 157-159).

As India sought to develop an Integrated Guided Missile Development Programme (IGMDP) — its own notions of purely civilian application gave way to the pursuit of dual-use technology. Scientists such as APJ Abdul Kalam, who once headed the Satellite Launch Vehicle (SLV) 3 project at ISRO, were called upon to serve in the Defence Research and Development Laboratory (DRDL) at Hyderabad — where pioneering research and development activities centered around the Indian missile programme were based. Under Kalam, the Indian team at DRDL appropriated the SLV-3's first-stage system to device the now-iconic Agni missile, with a range of 2500 kilometers. Indian missile programme under Kalam would also see additional improvisation not necessarily linked to its civilian space program. The IGMDP would go on to give rise to India's other signature missile defence systems such as Prithvi, Trishul and Akash. The establishment of a common Indian industrial base hence led to the country pursuing civilian rocket programs via ISRO and military programs via DRDL (Mistry 1998: 156-157).

By the 1990s, India's space programme had a visible overlap with its military program, granting the country with strategic military assets such as the intermediate-range nuclear delivery system Agni. India's assets in space also gave the country some advantage over its

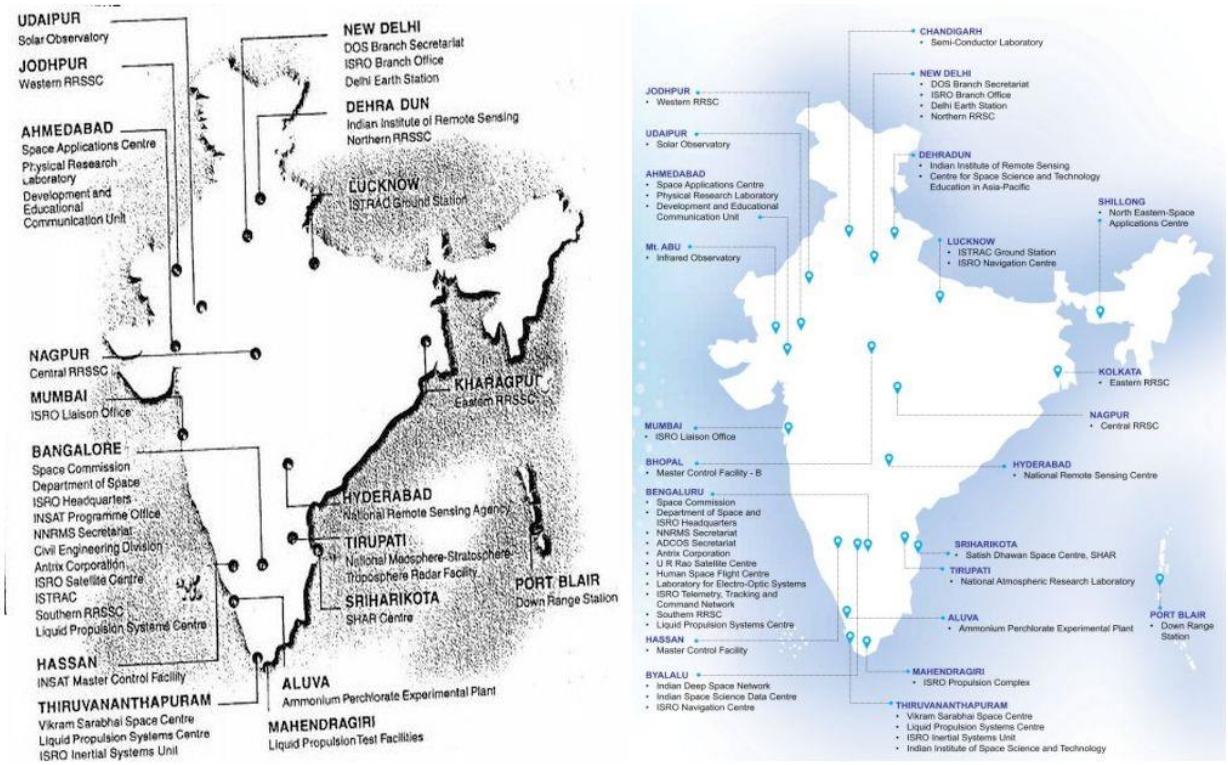
South Asian counterparts in terms of communications and reconnaissance capabilities, and India's SLVs showed potential for dual-use as ballistic missile launch platforms (Mistry 1998: 161-163). Also, by the 1990s, India's space programme would grant the country advanced capabilities in the areas of meteorology and remote-sensing to build closer ties with its South Asian counterparts (Mistry 1998: 167). India would later employ these advantages to pursue its foreign policy objectives in South Asia in the 21st Century.

The military dimension of the Indian space programme would soon come under adverse international scrutiny with the US imposing sanctions on ISRO in May 1992 to impede New Delhi's acquisition of cryogenic engine technology from Moscow — given the dual-use nature of the technology with claims that it violated international norms set under the MTCR — causing damage to India's overall space exports (Frank 1993: 69-70).

In a commentary titled *Satellites and Plowshares: The Potential Demise of the Indian Space Program* — published in the Spring 1993 volume of the influential *Harvard International Review* — staff writer Brian Frank argued against the logic of a developing India pursuing a launch capability as a part of its space programme, given the potential military applications. Frank stated that ISRO's SLV-3 launch system had overt Intermediate Range Ballistic Missile (IRBM) capability, and its Super Polar Satellite Launch Vehicle (SPSLV) and Geosynchronous Satellite Launch Vehicle (GSLV) systems both had Inter-Continental Ballistic Missile (ICBM) capability — ostensibly causing an alarm in the international as well as domestic opinion on the country's potential to upset the balance of power in South Asia and beyond (pp. 69-70).

Frank (1993: 69-70) also argued that a discontinuation of ISRO's launcher programme — and an abiding adherence to purely civilian applications — would enable greater international cooperation and domestic support for its space programme. Frank called for a cancellation of ISRO's launcher programme based on his assumption that outside powers would be more willing to launch India's space assets — particularly given the end of the Cold War — if it was seen to be a purely civilian programme, and on his reading of ISRO's capabilities for creating a credible launch system without external support as being weak and cost-inefficient. Frank stated that if the Indian military 'needs the bellicose potential of the program it can pursue the rocket capability itself (outside of the space program altogether), instead of jeopardizing the entire program' and that 'the Indian government

should decide its true intentions and then follow them overtly, without risking the future of the satellite program.'



Evolution of space centres in India, 1998-2019 (Press Information Bureau, Government of India 1998: 8; Department of Space, Government of India 2019: 20).[56]

Though the US sought to limit ISRO's ambitions by sanctioning the supply of cryogenic engines to India by Russia during 1992-94, New Delhi managed to acquire the cryogenic engines from Moscow without technology-transfer and went on to embark upon an indigenous programme of its own to develop cryogenic engines in the country. The first stage of the Indian GSLV project utilized imported cryogenic engines while the country increasingly sought to develop indigenous ones for subsequent stages. India was faced with embargoes from the Missile Technology Control Regime (MTCR), and this led to a predictable increase in costs of ISRO projects but these constraints were still not potent enough to

[56] Refer to Appendix 5 for latest details of space research centres in India.

significantly halt the overall advance of the Indian space programme despite a denial to access global space science and technology (Mistry 1998: 157-159).

By the end of the 20th Century, the Indian space programme had yielded dividends of critical national interest in the areas of communication, meteorology, disaster management and natural resource management for the country. Despite US-led sanctions, India had managed to not only operationalize its PSLV launch system but had also placed its GSLV launch system under active development. The core postulates of national development and self-reliance also held firmly in New Delhi's calculations through the 20th Century in terms of its space programme. Furthermore, despite US-led sanctions, India served as the Chair of the UN Committee on Peaceful Uses of Outer Space in 1998; participated in international efforts to address shared atmospheric challenges; aided international search and rescue missions; and contributed to the global advancement of space education — most notably by setting up of the UN Asia-Pacific Regional Centre for Space Education in India, meant to share the country's experience in developing and applying space technology to address social needs, in November 1995 — during the last decade of the last century (Press Information Bureau, Government of India 1998: 7-8).

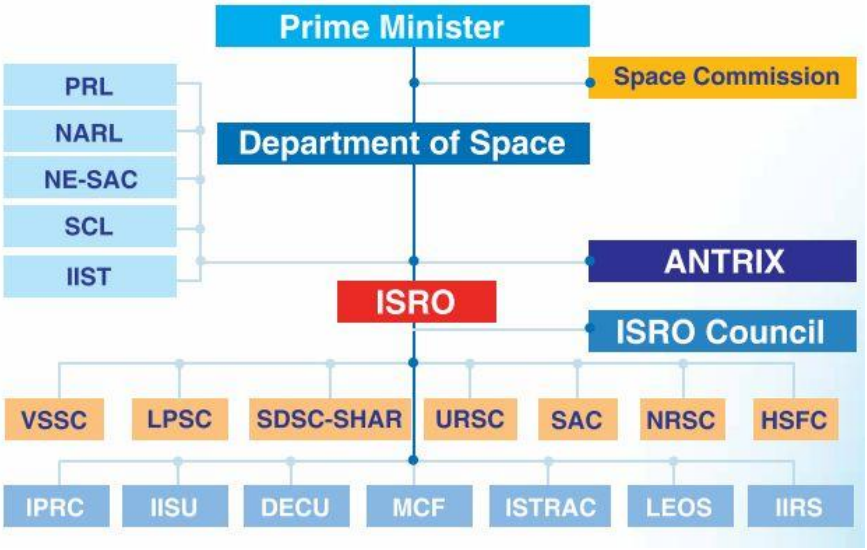
ISRO would go on to endure a potent measure of isolation from mainstream space engagement in the international system due to US-led sanctions until 17 September 2004 — by when Washington, DC removed the premiere Indian space organization from its Department of Commerce Entity List, and further sought to relax its space technology export controls to New Delhi in a bid to build a more comprehensive strategic partnership (Ereli 2004). Following the removal of US-led sanctions, ISRO benefited from unrestricted space cooperation with not only the US but from India's other space-faring strategic partners and continues to do so during contemporary times.

According to the Department of Space, Government of India (2019: 12), the Space Commission and the Department of Space (DoS) were constituted by the GoI in September 1972 — and ISRO has been functioning under the DoS since then. Furthermore, according to the same source:

Space Commission formulates the policies and oversees the implementation of the Indian space programme to promote the development and application of space science and technology for

the socio-economic benefit of the country. DOS implements these programmes through, mainly, ISRO, Physical Research Laboratory (PRL), National Atmospheric Research Laboratory (NARL), North Eastern-Space Applications Centre (NE-SAC) and Semi-Conductor Laboratory (SCL). Antrix Corporation Limited, established in 1992 as a Government owned company, markets the space products and services.

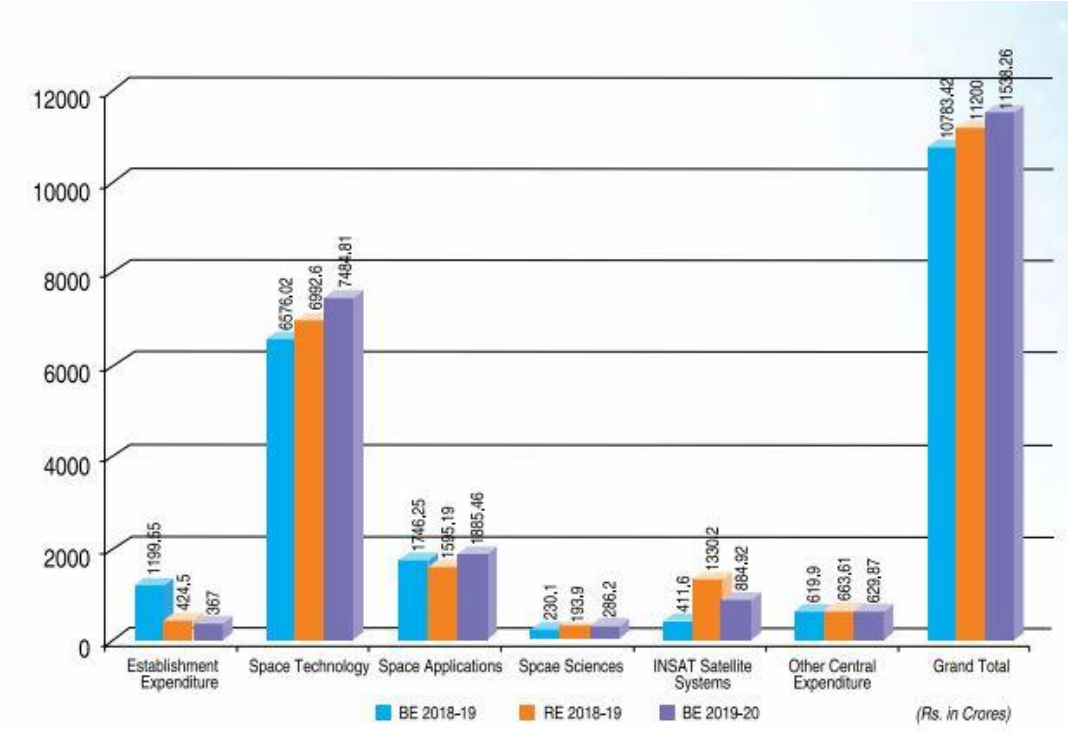
The establishment of space systems and their applications are coordinated by the national level committees, namely, INSAT Coordination Committee (ICC), Planning Committee on National Natural Resources Management System (PC-NNRMS) and Advisory Committee for Space Sciences (ADCOS).



Organizational structure of ISRO, as per Department of Space, Government of India (2019: 21).[57]

[57] Key to abbreviations, as per Department of Space, Indian Space Research Organization (2019a: 21): PRL: Physical Research Laboratory; NARL: National Atmospheric Research Laboratory; NE-SAC: North Eastern Space Applications Centre; SCL: Semi-Conductor Laboratory; IIST: Indian Institute of Space Science and Technology; ISRO: Indian Space Research Organisation; Antrix: Antrix Corporation Limited; VSSC: Vikram Sarabhai Space Centre; LPSC: Liquid Propulsion Systems Centre; SDSC: Satish Dhawan Space Centre; URSC: UR Rao Satellite Centre; SAC: Space Applications Centre; NRSC: National Remote Sensing Centre; HSFC: Human Space Flight Centre; IPRC: ISRO Propulsion Complex; IISU: ISRO Inertial Systems Unit; DECU: Development and Educational Communication Unit; MCF: Master Control Facility; ISTRAC: ISRO Telemetry, Tracking and Command Network; LEOS: Laboratory for Electro-Optics Systems; IIRS: Indian Institute of Remote Sensing.

Aliberti (2018: 59-60) draws on ISRO statistics to note that the total manpower under the organization in 2016 had reached 16,902 personnel — ahead of the 14,716 personnel employed in 2012. By 2015-16, over 72% of the net ISRO workforce was devoted to its S&T activities and the remaining attended to other duties, such as administration. Given the limited capabilities of the early Indian industrial base, the participation of the private sector in supporting the country's initial space activities was weak, burdening ISRO to largely ensure the development of its own supply chain until the mid-1970s — when the organization initiated a scheme of technology transfer to the private sector with intention for buybacks. The advent of this supply ecosystem led to ISRO procuring sub-systems such as structures, liquid engines, control components, electronic systems etc. from the private sector over the last four decades. Since the 1970s, the Indian supply ecosystem to ISRO has created over 500 industrial entities, mostly SMEs. Given the overwhelming support of the private sector in supplying critical components for vital projects such as the PSLV launch programme and the Mars Orbiter Mission (MoM) by 2016, ISRO created two steering committees in the same year for designing strategies to enhance its linkages with the private sector (Nagendra 2016: 238; Aliberti 2018: 59-63).



ISRO budget profile as per Department of Space, Government of India (2019: 21).

India's budget allocations for ISRO have also showed an upswing in recent times, with the organization being apportioned 102.52 billion INR in FY 2019-20, ahead of a revised estimate of 99.18 billion INR in the previous FY 2018-19, which was itself an increase from the 80.53 billion INR being allocated in FY 2017-18. However, the major segments for budget allocation remain space technology, space applications and INSAT satellite systems (Chaitanya 2019).

India has developed its own legal and policy frameworks to guide its space activities in accordance with its national needs and international laws. India finalized the *Satellite Communication Policy* to guide the country's communication satellites and ground support industry in 1997, and updated it in 2000. New Delhi also released the *Remote Sensing Data Policy* in 2011 — setting conditions for the acquisition, utilization and sharing of remote sensing data for development applications (Lele 2016: 129).

India's space policy articulation has largely been preoccupied with satellite communications and remote sensing. The country's space programme was focused on civilian aspect of securing development since its inception and this may have led to impressive gains in the domain of space technology but has also led to a sense of ambiguity prevailing in the direction of a comprehensive national space policy. This lack of formal articulation might not necessarily translate to a lack of vision in the field of outer space. India has a broad vision for pursuing its activities in the realm of space technology and there may be no urgent need for a drastic declaration of a national space policy. Indian public policy — including its space policy — has to be formulated at three levels, which are national, state and local. Since the policy has to adhere to not only the Indian Constitution but also the many actors at various levels, any formal steps require a slow and deliberate process given India's vast size, its federal structure and the pre-existing range of multiple actors, including the government and non-government stakeholders. Also, a complex matter such as space policy depends upon the input of a very limited group of active specialists who have demonstrable and ongoing experience in the subject in India. For any policy to achieve legitimacy in an environment as vast and complex as that of India it would require a mix of financial wherewithal, specialist input and political consensus that is difficult to obtain in the Indian environment (Nair 2016: 177-179).

Furthermore, although India might be an established world power in the domain of space technology — the field itself is of recent emergence. This creates a challenge since India cannot rely on a vast history — unlike its policies in the field of shipping, railways and roadways — to draw lessons from since the inception of the space age itself might be traditionally dated to the launching of Sputnik by the USSR in 1957. However, India has responded to new fields in which policy-making was required such as aviation with a National Civil Aviation Policy of its own in 2016, and the lack of historical antiquity only has a limited albeit noteworthy bearing on the actual formulation of a comprehensive national space policy. The formulation of a national space policy — given its vast applications but demanding investments that may provide returns of national value only in the long term — further becomes difficult in the Indian environment given the fact that it has to cater to the aspirations of over one billion people, out of whom millions survive below the poverty line. Furthermore, India is not a tightly-knit, mildly populated and developed nation-state such as Germany or Japan — both of which have a declared space policy (Nair 2016: 177-183).

While India might not have an all-arching national space policy, it does have multiple organizations, including those in the domain of space technology either in the public or private sector, with clearly defined objectives — and this further complicates things in terms of articulating a national space policy since not only these objectives but the aspirations of the multiple other stakeholders have to be harmonized to create a viable national space policy. Furthermore, India is a participant to several international commitments which have to be factored in to shape a national space policy which is in alignment with global norms and aspirations. There is an argument to be made that the original vision of Vikram Sarabhai should continue as the core guiding element of Indian space policy. This argument gains traction since very few space-faring states in the international system actually have a declared national space policy. In fact, while states such as the US, Japan, Canada, Germany and Australia do have a declared space policy — others with a competent launch, manufacture and ground support system such as Russia, China, France, Israel, the UK, Italy, Brazil, South Korea and South Africa have yet to declare a national space policy. A haste to declare a space policy urgently might be counter-productive for India's national interests

since the country is in no pressing need for a definitive articulation and might falter with a hurriedly cobbled-together policy and vision (Nair 2016: 179-183).

More recently, the Department of Space, Government of India (2020) introduced its Draft Space Based Communication Policy of India — also known as the Spacecom Policy 2020 — to regulate space communication in India and ensure greater participation of the private sector. Another draft policy — the Draft Humans in Space Policy for India, 2021 — was introduced by the Department of Space, Government of India (2021) to create optimal conditions for a sustainable Indian human space exploration programme.

India's Diplomacy for Space Technology

In 1957, the Uttar Pradesh State Observatory in Nainital began the photographic tracking of earth satellites in partnership with the Smithsonian Astrophysical Observatory in one of India's first instances of the country pursuing Space Diplomacy as a state (Daniel 1992: 488-489).

A newly-independent India would soon come in contact with two competing powers, each vying to operationalize Space Diplomacy for their own national interest and foreign policy objectives. Entering Space Diplomacy in an era of competing superpowers would bring its own unique advantages and disadvantages to an Indian leadership committed to the ideals of non-alignment. On 20 January 1960, India hosted Kliment Efremovich Voroshilov, the President of the USSR, in a state banquet held at the country's *Rashtrapati Bhawan* — the President's Official Residence. In his welcome address, the then Indian President Dr. Rajendra Prasad noted the vast advances made by Soviet scientists and technicians in the field of S&T. Dr. Prasad stated that the Soviet 'scientists have conquered space and brought within the grasp of man what seemed altogether unattainable.' Dr. Prasad further noted the commitment of Soviet Union and India towards internal diversity, prosperity and externally, a commitment towards the ideal of world peace. The Indian President noted Soviet assistance in the field of S&T which culminated in the finalization of landmark projects of national significance as the Bhilai steel project. Dr. Prasad also noted that people-to-people

contact, especially in the field of S&T was a welcome aspect of the bilateral relationship (Prasad 1960: 18-19).

In his reply to the Indian President's address, the Russian President Voroshilov affirmed the affinity between the people of the two states and invoked Vladimir Ilych Lenin as a 'great champion of freedom for all peoples' who believed in the freedom and post-colonial national progress of India. Noting the warmth in bilateral ties, the Soviet President remarked that the 'Soviet-Indian economic, scientific, technical and cultural ties are growing' and went on to observe the global significance of Soviet-India ties (Voroshilov 1960a, 19-21). President Voroshilov — in his farewell address held at the Ashoka Hotel, New Delhi on 22 January 1960 — reaffirmed the warmth in bilateral ties and commitment to assist India in industrialization and S&T. Emphasizing on the might of the Soviet scientists, Voroshilov stated that 'the entire world has learnt about the new achievement of Soviet science and technology; the successful launching of our experimental rocket to an area in the Pacific. The Soviet rocket flew about 12,000 kilometers with the speed of over 26,000 kilometers per hour and deviated from the target area by less than 2 kilometers from the predetermined spot. This is another important step ahead on the way to harnessing outer space and studying flights toward planets of the solar system.' The Russian President invoked his country's socialist system as the reason for its progress (Voroshilov 1960b: 20-22).

By the time Voroshilov made his speeches in India, the Soviet Union was already locked in a race for primacy in the fields of nuclear and space technology with the United States of America — its arch-rival and competing superpower in the international system at the time. During the Cold War, the US space programme came to become a conscious extension of the country's foreign policy. The US recognized the prestige that progress in the field of S&T granted a state and sought to answer the Soviet challenge in the domain of outer space with a robust programme of its own. By the mid of 1965, the US National Aeronautics and Space Administration (NASA) had engaged 69 states in space cooperation. The United States Government (USG) also sought to promote UN participation in international space activity by this time. International activities tied to the US space programme had a utilitarian dimension, such as ensuring tracking stations across the globe. But the realist rewards of

achieving a prime global space programme were also in the calculations of the American decision-making apparatus (Skolnikoff 1967: 25-27).

Indian scientists during the 1950s became proficient to study critical aspects of the atmosphere such as the electrojet from sites such as Thumba in the Kerala state. Indian institutions such as the Physical Research Laboratory under Vikram Sarabhai sought to investigate vital aspects of space research such as the properties of cosmic rays. Despite internal competence, India required to access global advances made in the field of space studies for studying complex phenomenon in the atmosphere and beyond, and this culminated in shape of India reaching out to states such as the US for an early cooperative assistance. NASA provided the Indian installation at Thumba with tracking and telemetry equipment, including a Doppler Radar trailer and a launcher for Nike-Apache sounding rockets. France provided India with launching platforms for Centaure rockets. The Soviet Union provided advanced equipment such as range-survey helicopter and the Minsk digital computer. The UK, too, collaborated with India's Tata Institute of Fundamental Research in the study of cosmic rays. India benefited from this access to space S&T provided by the US, France, Russia, Canada, UK and even managed to secure UN funds for setting up a satellite communications antenna at the Physical Research Laboratory, Ahmedabad. This access to space technology would prove crucial for Indian space programme as India increasingly sought to indigenize foreign equipment in attempts to create Indian versions of the latest space technology, often improving or modifying received technology (McElheny 1965: 1487-1488).

The Department of Atomic Energy (DAE) inked its first major bilateral engagement with the United States National Aeronautics and Space Administration (NASA) on 11 October 1962. This instance of cooperation came in the form of Memorandum of Understanding for Co-operation in Space Research in which both sides agreed to 'affirm a desire to continue cooperation in space research of mutual interest for peaceful scientific purposes.' NASA agreed to support the DAE in conducting 'two initial scientific experiments to be conducted by means of sounding rockets to be launched from a site in India near the geomagnetic equator' and further agreed to 'continue discussions of additional experiments of mutual interest with a view to their future implementation'. India benefited by the provision of US

equipment, training and advise in the field of space technology. Both sides further agreed that 'the facilities to be established at the sounding rocket launching site near the geomagnetic equator will be made available for use by other countries for appropriate experiments in peaceful space research' and that 'all experiments and experimental results will be open to the world scientific community' (Government of India and the Government of the United States of America 1962).

Soviet assistance to the Indian space programme would ultimately prove to be more decisive through the 20th Century than assistance provided by the US and its western allies. On 19 April 1975, India joined the select club of states to have sent an indigenous satellite into space. The satellite — named *Aryabhata* after the ancient Indian astronomer — still relied on Soviet launching and rocket capabilities to be placed into its orbit. By this time, India's ISRO already had plans in place to develop its own launching facility at Sriharikota and its own launching rockets meant to send satellites into space. The incumbent Indian President Fakhruddin Ali Ahmed remarked that this successful experiment had placed India on the map of global space science (Science News 1975: 271).

Unlike the Indian nuclear programme, the country's space programme would enjoy longer support from the US given its yet civilian nature. Shrivastava (1975: 4-5) noted that by 1975, NASA, ISRO and All India Radio had already embarked upon the ambitious Satellite Instructional Television Experiment (SITE) meant to provide educational broadcasts covering critical issues such as family planning, health and agriculture via television to 2400 villages across six clusters of 400 villages each in Karnataka, Andhra Pradesh, Odisha, Bihar, Madhya Pradesh and Rajasthan. NASA provided the Applications Technology Satellite-6 (ATS-6) satellite for the experiment while India provided the ground support.

The SITE experiment — which was conducted between August 1975 to July 1976 — was also a landmark in terms of Indo-US commercial space cooperation. SITE's success — culminating in educational content worth approximately 1400 hours meant for about 2.8 million viewers on a daily basis — led to India seeking further cooperation from US-based Ford Aerospace to avail commercial satellite support to continue broadcasting educational content once the one-year experiment had ended, bringing Indian capital to American businesses. But beyond

education and commerce, it was also a joint mass communication project which was unprecedented in terms of scale at the time (Krige et al. 2013: 244-246).

Indira Gandhi (1982a: 194-196) — in her address to the AAAS on 30 July 1982 in Washington, DC — noted that India as a state was far too unmanageable to secure meaningful national development through external interference and thus the thrust to address its national issues had to come from within. Gandhi stressed that India engaged in advanced areas of science despite being a developing state since it saw scientific progress as critical to addressing its national development challenges. Gandhi (1982a: 194) noted that: 'We see our space efforts as relevant for national integration, education, communication and the fuller understanding of the vagaries of the monsoon, which rules our economic life. Mapping from the sky also gives information about natural resources. Oceanography augments food and mineral supplies. Modem genetics open out vast possibilities. Home-grown expertise has helped our oil exploration. Had we been wholly dependent on foreign experts we would not be producing 16 million tonnes of petroleum a year.'

Many of India's choices for partnership in the domain of Space Diplomacy during the 20th Century stemmed from technical expediency rather than prolonged political deliberation. India relied on the Viking engine from France to develop its own PSLV liquid fuel engine and on Russian cryogenic engines for developing its GSLV system (Mistry 1998: 161-163). Korovkin (2017: 257-258) states that — to fill the gap in India's capabilities in terms of launch vehicles for establishing satellites into the Earth's orbit — New Delhi embarked on negotiations with the Soviet Union during its final years in the late 1980s for supply of cryogenic engines with technology transfer that culminated in a contract with post-Soviet Russia in 1992, which came under US-led sanctions. Korovkin (2017: 257-258) states that India and Russia entered into a new contract in 1994 with Russia supplying India with seven large cryogenic engines without any technology transfer. These were assimilated into the Indian space programme in the operational form of the GSLV MK-I launch vehicle, first tested on 18 April 2001, and eventually leading to the more dependable GSLV MK-II systems.

Bagla (2019) notes the limitations of technology denial to states committed to the pursuit of technology such as India in case of its space programme. Bagla notes that the denial of cryogenic engine technology — an essential technology for developing launch vehicles since

the 1990s — meant for India from Russia under US-led sanctions during the 1990s actually led to further innovations. India managed to secure the engines themselves despite delay and the country's scientists managed to develop the GSLV series of launch vehicles and furthermore managed to create Indian versions of cryogenic engines. Bagla (2019) states that when 'when fish was denied to India, India went out and learnt fishing'. Bagla (2019) situates US-led technology-denial as a 'blessing-in-disguise' for the Indian space programme since it spurred much-needed space innovation in the country given its committed leadership and a competent pool of space scientists.

In the 21st Century, a post Cold War and increasingly economically affluent India sought to build bridges in space technology with the US — and this most significantly culminated in ISRO being removed from the US Department of Commerce's Entity List as a part of the Next Steps in Strategic Partnership (NSSP) signed between the two democracies in 2004. As Indo-US ties strengthened, India's premier institutions such as the Vikram Sarabhai Space Centre, Liquid Propulsion Systems Centre and Satish Dhawan Space Centre also came to operate without US restrictions, and this led to closer cooperation between NASA and ISRO. This cooperation would soon yield outcomes of global value as US instruments abroad India's moon-probe Chandrayaan-1 led to the discovery of water molecules on the moon. India further garnered NASA support for its Mars Orbiter Mission (MoM) — or Mangalyaan — project, gaining international prestige and recognition as the first state to successfully reach Mars in its first attempt by sending the space-probe to the Red Planet (Reddy 2017: 169-172).

Samson (2017: 235) notes that the Indo-US bilateral cooperation in the domain of space technology has a history of over half a century and has not only resulted in gains in terms of S&T achievements — mainly focused on civilian applications — but has also led to deepening of bilateral ties between the world's two largest democracies. Samson (2017: 235-236) situates the cooperation between the two states in the 21st Century as having benefited from the meeting of the *US-India Civil Space Joint Working Group* in 2005 and having blossomed with the launch of India's *Chandrayaan-1* lunar mission — which in 2008 carried NASA instruments that led to the discovery of water molecules of the lunar surface. Samson (2017: 236) notes that both states created the *Mars Working Group* after having successfully

entered the Mars orbit via their independent missions within 48 hours of each other in September 2014. Furthermore, both states share a *Heliophysics Working Group* to jointly address efforts to explore the Earth's Sun. Samson (2017: 236) states that the July 2016 *Memorandum of Understanding* reached between ISRO and the United States Geographical Survey (USGS) allows the two states to share and exchange data through their extra-terrestrial assets such as NASA's LANDSAT-8 and ISRO's RESOURCESAT-2 satellites. Given the extent of cooperation between the two states in the realm of outer space, Samson (2017: 236) opines that it might be possible for India to participate in the upcoming *International Space Station* project led by NASA and the European Space Agency.

Samson (2017: 236) notes that since the June 2016 *Indo-US Joint Statement* the US has recognized India as a major defence partner and both states since then had reached an understanding that if India takes adequate measures for monitoring its export controls, the US would provide it with a range of dual-use capabilities mainly for civilian purposes such as inter-planetary exploration and earth observation, including manned space probes. Samson (2017: 237) states that India's NAVIC satellite navigation system — known also by its earlier name Indian Regional Navigation Satellite System (IRNSS) — draws from both the US-led GPS and Russia-led GLONASS systems, creating questions for Indo-US compatibility and interoperability given ongoing US-Russia tensions. Samson (2017: 238-239) states that both India and the US share common interests in cooperating on Space Situational Awareness (SSA) and Maritime Domain Awareness (MDA). Furthermore, both states have shown an intention to cooperate further in both the domains.

The *India-France Joint Vision for Space Cooperation* — signed in New Delhi on 10 March 2018 — states that both states 'share a unique and historical partnership in the peaceful uses of outer space' and further seek to strengthen the strategic partnership by cooperating in joint missions to analyze the Earth's weather and climate; mutually share data from Earth observation satellites to aid in purposes such as meteorology, oceanography and cartography; and share expertise in data analytics. ISRO and CNES agreed to 'a joint earth observation mission with high resolution imaging capability in optical and microwave domains' and further sought to jointly cooperate for the security of each other's strategic assets in land, sea and space. ISRO and CNES in 2018 sought to work together on satellite

navigation technologies as well as navigation of rovers on both Moon and Mars. Both agencies agreed to work together on joint planetary exploration as well as improve capabilities for human exploration of space and space transportation systems (Government of France and the Government of India 2018).

Korovkin (2017: 259) notes the limits of Indo-Russian space cooperation in the 21st Century, and situates it with the examples of GLOSNASS and Chandrayaan-2 — both cases where India sought Russian cooperation but would fail to secure it. New Delhi signed the agreement for launching Russian GLOSSNAS satellites through its GSLV launch systems and gaining access to their positioning data with Moscow in 2004. Despite the signing of another revised agreement in 2007, Russia launched all GLOSSNAS satellites on its own — not providing a reason in the public domain for leaving India out of the process. However, the two sides reached a separate agreement in 2011 for the Indian military gaining preferential access to GLOSSNAS data. Another prominent case of Russian refrain in cooperating with India was in the lack of provision of a landing module for India's Chandrayaan-2 lunar mission despite a bilateral agreement being reached for it in 2007. Moscow rescheduled the delivery of the lunar landing module to 2013, and then to 2016. By then, ISRO declared that that it will build the lunar landing module on its own and rescheduled its own launch of Chandrayaan-2 to 2018.

Suzuki (2017: 280) states that the rise of China — with its growing power projection in the South China Sea and expanding influence in Asia as an outcome of its *Belt and Road* initiative — has led to a consequent Japanese strategy for seeking strategic partners in Asia, and this lends importance to Indo-Japan cooperation. Suzuki (2017: 281) further contends that India and Japan have different but complementary space capabilities suited to each other's national interest. India has a vast array of earth observation and cartographic space assets which could lend strength to Japan's high-priority disaster management needs. Japan has hardware for monitoring weather and humidity, which can be used by India to address its agricultural and environmental concerns.

Sourbès-Verger (2016: 3-16) notes the increasing dependency on space technology in both Europe and India and goes on to state that — despite some political differences — there exists a viable potential for both entities to enhance further cooperation in the space sector

in the international system, especially given a long history of already existing cooperation. Held (2017: 290-292) notes that there exists a potential between India and Australia to emerge as partners in space sector — including in the commercial sector with or without government involvement. Paikowsky and Barok (2017: 267) note that the Indian space programme 'serves its broad strategic interests, the goal of which is to situate India as a significant player in world politics.' Paikowsky and Barok (2017: 265-268) further note that cooperation between India and Israel has also deepened during the recent decades and that there exists a potential to deepen bilateral ties in space given Israel's expertise in utilizing space technology for national security applications and India's expertise in utilizing the same for addressing civilian challenges. Paikowsky and Barok (2017: 265-271) posit that India and Israel have *complementary* capabilities that the other can utilize for furthering national objectives — and this forms the basis for bilateral cooperation in space technology for mutual benefit.

Since the inception of the *Make in India for the World* programme, the country has sought to attract 100% FDI under DoS regulations for constructing and operating satellites. New Delhi's *Aatmanirbhar Bharat* initiative — meant to secure maximum self-reliance for the country in an era where supply chains were disrupted due to the ongoing COVID-19 pandemic and ensuing changes in the international system — also attracted foreign electronics and semiconductor manufacturers to the country as an outcome of its Production Linked Incentive (PLI) scheme, which sought to boost India’s manufacturing capabilities (Giri 2021: 67-69).

The country's *Draft Humans in Space Policy for India, 2021* seeks to enable 'sustained human presence in space as an instrument for development, innovation and foster collaborations in alignment with national interests.' The draft policy commits to ensuring India's human presence in space — including setting optimal conditions for realizing human space flight to the Lower Earth Orbit (LEO) in the short-term with a more ambitious Indian human space exploration programme as the long-term objective. Realizing the role of 'non-traditional' actors in global space economy, the GoI seeks greater participation of the private sector to aid its national objectives. The draft policy is notable since it allows for reliance on not only India's domestic space support ecosystem but also deeper engagement with the country's

partners in the international system to achieve its objectives (Department of Space, Government of India 2021).

India's Space Diplomacy for Advancing Foreign Policy Interests

Bagla (2019) contends that space policy in India is marked with continuity since the inception of the Indian space programme. In terms of intentions, India has sought primacy in the in the international system in terms of space technology since the rise of state-sponsored space research in India under Dr. Vikram Sarabhai. One element of continuity is the utilitarian aspect of the Indian space programme, with which New Delhi has sought to benefit its own citizens, and increasingly its neighbors and other states in the international system. India has also sought indigenization of its space assets given its long history of facing technology denials, and has gained a measure of success in this regard in the 21st Century. In contemporary times, India utilizes its space assets for weather forecasting, agriculture, financial technology, broadcast communication and national security purposes. Bagla (2019) states the development of the space programme as having the backing of the Indian government, and particularly the Modi administration's agenda to deliver a 'New India'.

Selvamurthy (2019b) situates S&T Diplomacy in the 21st Century as belonging to the strategic and non-strategic sectors. Selvamurthy notes India’s supply of radar technology to Sri Lanka, and the attractiveness of the country’s advanced defence systems such as the BrahMos missile to address security requirements of its strategic partners. In the non-strategic sector, Selvamurthy (2019b) notes that India in the 21st Century has the capacity to launch satellites for other states in a cost-effective manner, further deepening ties with other states with an eye on achieving critical foreign policy objectives such as obtaining a permanent United Nations Security Council (UNSC) seat. Selvamurthy (2019a) states that India’s advances in the 21st Century — given its launch vehicle technology as well as ability to craft satellites in the domain of topography, military, weather, natural disaster management and navigation etc. position the rising power as a potential provider of space technology to other states.

Lele (2016:131-133) notes that while India's space programme was meant primarily for the state's own national progress and while success in the field of space technology was never assured for a developing economy such as India, the country still succeeded in the field of space technology based on its technological and diplomatic efforts and now finds itself in a position to utilize this advantage to pursue its larger foreign policy objectives. According to Lele, India was a unique developing economy that had both the intention and the capability to secure progress in the field of space technology since the inception of its space program. India further survived stringent technology-denial regimes and went on to build a cost-effective and frugal space programme which was capable of reaching distant stations in Moon and Mars. India's successful PSLV launch system and its launch stations with close proximity to the equator enabled the country to emerge as an attractive provider of commercial satellite launches. Lele opines that these factors have soft power implications for the rising power. Lele concludes by noting that 'India is on the path to exert influence in or from space both during peace and war. This represents the beginnings of space power projection across soft and hard domains' (Lele 2016:131-133).

21st Century India emerged as a state with demonstrable capability to provide satellite launching and space science assistance to other states in the international system, including its more developed counterparts. India's Oceansat-2 provided data to the US to aid in its disaster management and rescue efforts in the face of Hurricane Sandy. India has also launched satellites for developed and technologically advanced countries such as France and Israel — granting the country a level of prestige matched only by a select few other states in the international system. Within South Asia, India launched the *SAARC satellite* — meant for common use by other South Asian states — and further shared the Indian Regional Navigation Satellite System (IRNSS) with its SAARC counterparts, enhancing their navigational, disaster management, monitoring, and remote sensing capabilities. Beyond South Asia, India has proceeded to set up ground stations in distant South Eastern states such as Vietnam, where data from Indian satellites will also help other states in the South East Asian region in their national disaster forecasting and development efforts (Reddy 2017: 169-172).

Bagla (2019) situates the launching of satellites by India for other states — including technologically advanced states such as Italy and Israel — as an effort that builds inter-state ties and also earns revenue. Bagla also situates the SAARC satellite — which was launched as the *South Asia satellite* by India as a source for granting enhanced communication and connectivity capabilities to its South Asian neighbors excluding Pakistan — as an exercise in Indian diplomacy. Bagla (2019) further situates India's incumbent PM Modi as a leader who seeks to utilize the country's space programme as not only a tool for governance but also a tool for diplomacy.

21st Century India's leadership has sought to utilize its space assets for diplomacy by collaborating with other states in the international system — including those from the Global South with modest spacefaring capabilities — to enhance the country's global reputation and influence as a technologically advanced power. This cooperation in general allows India to build deeper ties with developing states — such as Brazil, Egypt, Indonesia, Kazakhstan, Mauritius and Mongolia etc. — which seek Indian assistance and cooperation for building their own space programmes and also with states from the Global North — such as UK, US, Canada, France, Germany, Israel, Italy, Japan etc. — for whom India has launched satellites (Lele 2016: 125-129).

Lele (2016: 126) remarks that: 'International cooperation, while mutually beneficial symbolically, brings with it a deeper strategic impact on global perceptions. When two states cooperate with each other in scientific and technological fields, the cooperation impacts the economic, commercial, and military relations between them.' Beyond states India also has multilateral agreements in the domain of space cooperation with transnational organizations such as the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) and the European Space Agency (ESA). India's rise a credible provider of space technology has led to the country undertaking joint space missions with other states and also providing data from its established space assets to its partners in the international system (Lele 2016: 125-129).

In 2010, Pant and Lele (58-59) noted that the Indian space programme had begun to display signs of not only civilian and commercial applications but also an increasing acknowledgement of the dimension of national security for addressing realist concerns. Pant

and Lele (2010: 58) argued that India stood to secure greater cooperation in space with fellow democracies such as the US, Japan and European states but had very little in common in terms of shared interests with its Asian rival China. Pant and Lele (2010: 58) also noted New Delhi's lackluster approach when it came to proceeding in a strategic dimension to address national interests given the overwhelmingly civilian nature of the ISRO-led space programme in India by 2010.

Lele (2011: 379) situates the India's national security interests as being threatened by the policies of neighbors such as China and Pakistan — two nuclear powers with which the country has previously fought wars and has ongoing territorial disputes. Islamabad enjoys close bilateral ties with Beijing. India also faces sub-conventional threats from Pakistan in the form of cross-border terrorism. India further faces security challenges in the shape of climate change, food security, health security and energy security. Lele (2011: 380) states that — to answer these challenges in the pursuit of state security — 'India follows a two-pronged approach of investing in indigenous development of technologies and also signing agreements for technology purchase/transfer with other countries. The Indian armed forces have a mix of both conventional and emerging technologies.' Lele (2011: 382) contends that space technologies offer India a means to address the security of its assets and interests outside its geographical confines, such its UN Peacekeeping deployments, oil & gas assets and maritime trade.

Lele (2011: 380-382) notes that — since the launch of its first satellite in 1975 — the Indian space programme was essentially oriented to answer the country's socio-economic challenges, instead of responding to military or security threats, and had gained strategic importance in the 21st Century with the launch of the Technology Experiment Satellite (TES) — a dual-use earth observation system — launched in October 2001. Lele (2011: 382-383) also notes the inherent dual-use nature of space technology and states that while using existing assets for aiding military purposes such as communication, reconnaissance and navigation may constitute militarization of space — weaponization of space only occurs once a state places 'weapons' into outer space with an intention to harm or impede assets of another state.

Lele (2016: 130) further situates India's satellite inventory as being capable of both civilian and military purposes, with a primary emphasis and focus on the civilian aspect. Lele opines that India's Cartosat series of remote sensing satellites have both civilian and military implications. Lele further notes that India has dedicated satellites for military purposes such as the GSAT-7 — successfully launched in September 2013 — meant to provide the Indian Navy with information about the Indian Ocean region, in which India seeks primacy (Lele 2016: 130).

In his address *India Stands Tall as a Space Power* — delivered on 27 March 2019 on the occasion of India having successfully launched its Anti-Satellite (ASAT) Missile — PM Modi declared that India had successfully shot down one of its own live satellites placed previously in the Low Earth Orbit (LEO), with an altitude of approximately 300 kilometers above the earth's surface, through an Anti-Satellite (ASAT) missile within three minutes. Modi (2019a) contended that this test, labeled *Mission Shakti*, was a complex operation in which the country had achieved its stated objectives. Modi (2019a) further noted that India had now entered the select group of countries to have possessed an ASAT ability, and was now a global space power having joined the ranks of previous powers with overt ASAT capabilities such as the US, Russia and China (Modi 2019a).

Modi (2019a) stated that as the importance of space assets grew so did the necessity to protect them. Modi further asserted that India's ASAT capabilities were not meant to answer to any other state but were a part of a Rising India's larger defensive posture in space. India's policy against weaponization of outer space remained unchanged and New Delhi viewed the test as being in the interest of 1.3 billion Indians and not in violation of any international agreement or understanding. Modi asserted that India's ASAT test ensured the security, development and technological progress of India — and that a strong India was vital to maintaining the peace and security in its region (Modi 2019a).

Bagla (2019) notes that the Sino-Indian rivalry has extended to space with India seeking to place its Mangalyaan probe as a technology demonstrator meant to assert of its primacy as an Asian spacefaring power. Suzuki (2017: 281) asserts that India and Japan require cooperation for enhanced Maritime Domain Awareness (MDA) in the Indian Ocean region — in which New Delhi finds itself encircled by China's *String of Pearls* strategy and Tokyo also

has to contend with an aggressive Beijing in the maritime sphere to address challenges to its energy and military security. Suzuki (2017: 282) states that with the advent of the *Basic Space Law* in Japan, the visions of both states in terms of outer space have become more aligned — and that both India and Japan have more scope for cooperation in the 21st Century. Lele (2019a) notes the success of the South Asia satellite and further notes the upcoming BRICS satellite, where Asian rivals India and China stand to potentially cooperate.

Rajagopalan (2019a) notes that, in the 21st Century, 'space is still as much about scientific discovery as it is about strategic competition'. Extrapolating on the Cold War, Rajagopalan seeks to situate advances in outer space with traditional terrestrial geopolitics — emphasizing on competition between states in the international system for achievements in the realm of outer space, including the formulation and creation of military components by individual states to add to their existing space policy.

Rajagopalan (2019a) notes that the number of states acting significantly in the realm of space technology in contemporary times surpasses the limited number of influential key state actors during the Cold War. Rajagopalan also notes the emergence of private sector actors into the domain of outer space to reinforce the point that competition for primacy in outer space in the 21st Century is fundamentally different from that during the Cold War. Rajagopalan notes the mounting competition in terms of power extending to the realm of outer space in Asia — and cites China as the key state in response to which other states such as India and Japan frame their competitive and cooperative strategies.

In terms of India as a state seeking to establish itself as an actor in the realm of outer space, Rajagopalan (2019a) notes India's cooperation with states with differing agendas and pursuits in the international system such as the US, France and Russia. Rajagopalan (2019a) also states that India has very limited cooperation in the realm of outer space with China and very limited competition with the rest of the significant actors in the same realm.

Samson (2017: 240-242) noted the alarm in the US satellite launch market for facing competition from ISRO in terms of cheaper launch vehicle capabilities for US satellite launches, and stated that this is an area of concern for Indo-US space cooperation. India's 27 March 2019 ASAT test also came with mixed blessings. On the one hand, the country had

demonstrated the capability to defend its assets in outer space on the other hand it led to short-lived disagreements with its strategic partners in the international system such as the US. Albert Condes — Associate Administrator for International and Inter-agency Relations, NASA — wrote a letter to the ISRO chairman K. Sivan on 29 March 2019 in which he objected to the generation of space debris as an outcome of the Indian ASAT test and further informed India that the activities pending under NASA-ISRO Human Space Flight Working Group were suspended until India declares a refrain from further ASAT tests. Condes held that other areas of Indo-US space cooperation were not impacted by India's ASAT tests (Foust 2019).

The US private sector also expressed alarm over the weaponization of space with the San Francisco-based *Planet* — an established client of ISRO that had positioned 88 of its CubeSats for launch abroad the PSLV in February 2017 and 16 CubeSats for launch abroad ISRO's November 2018 PSLV launch — explicitly condemning the Indian ASAT test via its official Twitter handle. Brian Weeden of the *Secure World Foundation* also found the Indian ASAT test as a breach of corporate social responsibility, which had profound consequences for civilian investment in space. Laura Grego of the *Union of Concerned Scientists* also noted that ASAT tests created not only debris but capabilities that threatened the peaceful and secure use of space (Werner 2019).

However, NASA Administrator Jim Bridenstine — in a letter to ISRO head K. Sivan on 4 April 2019 — stated that NASA would continue to work with ISRO on the NASA-ISRO Human Space Flight Working Group and other projects 'based on guidance received from the White House.' NASA's brief annoyance had yet to have any tangible impact on the Indo-US space cooperation, and the cooperation resumed despite a brief exchange of words — with the two states reaffirming cooperation for high-value missions such as NASA-ISRO Synthetic Aperture Radar (NISAR) and Chandrayaan-2 projects (Foust 2019).

The reasons why ISRO was able to avert major US ire despite NASA's displeasure with its ASAT test might rest with a broader US strategy that seeks India as a strategic partner and views the rise of Chinese and Russian technology in space with alarm. In a reference to Russia and China, The White House — in its *National Security Strategy of the United States of America*, published in December 2017 — noted that 'many countries are purchasing satellites to support their own strategic military activities. Others believe that the ability to

attack space assets offers an asymmetric advantage and as a result, are pursuing a range of anti-satellite (ASAT) weapons. The United States considers unfettered access to and freedom to operate in space to be a vital interest. Any harmful interference with or an attack upon critical components of our space architecture that directly affects this vital U.S. interest will be met with a deliberate response at a time, place, manner, and domain of our choosing' (p. 31).

Emphasizing on close space cooperation with India, American President Donald J. Trump — in his address *Howdy, Modi: Shared Dreams, Bright Futures* held in Houston, Texas on 22 September 2019 — remarked in the presence of the Indian PM Modi that India and the US 'will pioneer new frontiers in space, working together, raising the sights of humanity.' Trump (2019) further remarked that 'Here in America, we are creating the United States Space Force, and we're working closely with India to enhance space cooperation.'

Rajagopalan (2019a) notes that China's first successful Anti-Satellite (ASAT) test was conducted in January 2007 — and may have been carried out to demonstrate capability to respond to US advancements in the field. As per Rajagopalan, this has had an impact on India — and may have an impact on Pakistan. Rajagopalan dwells upon the history of India-Pakistan rivalry to situate the possible case of Pakistan developing counter-space capabilities in response to Indian advancements in the area.

Rajagopalan (2019a) holds that the traditional Indian approach towards outer space security — guided by its own limitations in the area — had been marked with opposition towards 'weaponization and militarization of space' with an added emphasis on 'the peaceful uses of outer space'. However, changes in the international environment — such as an increase of Pakistani competence in long-range missile technology and the US withdrawing from the Anti-Ballistic Missile (ABM) treaty in 2001 — including China's ASAT test in 2007, moved India to plan towards securing its outer space assets. India — a traditionally pacifist power in the domain of outer space — 'established a space cell under its Integrated Defence Headquarters shortly after China's ASAT test' (Rajagopalan 2019a).

By 2019, India had conclusively departed from its idealist position in the realm of outer space in favor of growing realism by establishing the Defence Space Agency (DSA) to manage the

state's military capabilities. As a rising power, India still does not control the international power dynamics in the realm of outer space — some of which may impinge upon its own national security and interests (Rajagopalan 2019a).

In April 2019, India founded the Defence Space Agency (DSA) — a military directorate with headquarters in Bengaluru that seeks to integrate the functioning of the New Delhi based Defence Imagery Processing and Analysis Center (DIPAC), Bhopal based Defence Satellite Control Center, and other military space assets under the control of the Indian armed forces. On 11 June 2019, an Indian cabinet committee headed by the PM also cleared the formation of the Defence Space Research Organization (DSRO) under the authority of the country's state-run Defence Research and Development Organization (DRDO). As an early function, the DSA sought to conduct its first simulated war-game labeled *IndSpaceEx* in coordination with the country's Ministry of Defence in July 2019, with an objective of assessing and situating the state of India's space security (Space Daily 2019).

Joshi (2019) notes that India's space programme — unlike many of its counterparts in the international system — had asserted itself as a civilian space programme, focusing on national development instead of national security through much of its history. Joshi also states that 'India has gone out of its way to make its programme as transparent as possible, providing all manner of details about the technologies it is developing, its test processes and so on.' Joshi contends one possible reason for India to maintain a space programme oriented towards its civilian requirements was to secure assistance from other states, which it managed in the programme's early history. However, since the country's Defence Research and Development Organisation lacked the technical wherewithal to develop its own advanced missiles, it deputed scientists such as APJ Abdul Kalam — who had previously worked on the SLV-3 launch programme for ISRO — into Indian missile programs such as the Agni series during the 1980s. This paved the way for the country to draw upon the dual-use nature of space technology.

Joshi (2019) states that since the 1980s, India had space assets with limited military applications such as the Indian Remote Sensing (IRS) satellites. Joshi also notes the launch of the Technology Experiment Satellite (TES) in 2001 as being of military value but ultimately marks the inception of the dual-use Indian satellites meant significantly for

military purposes to the Cartosat series — which since 2005 has provided the country's civilians and military with advanced imagery capabilities. Since 2001, India also fielded ground-based military facilities such as the Defence Image Processing and Analysis Centre based in Gwalior under its Defence Intelligence Agency (DIA).

Joshi (2019) notes that many of India's satellites — such as the Resourcesat 2, or its weather satellites such as SARAL, OceanSat 2, RISAT 1 and RISAT 2 — launched during the 21st Century also offer dual use to both the country's civilian and military establishments. However, the country took to dedicated military satellites only in 2013 with the launch of GSAT 7 in 2013 — meant for the Indian Navy — and then GSAT 7A in 2018, meant for the Indian Air Force. Other dual-use satellites — such as those part of the Indian Regional Navigation Satellite System (IRNSS) — service both civilian and military establishments in areas such as navigation.

Joshi (2019) also notes that India's counter-space capabilities are modest in comparison to other Asian powers such as China, with Beijing holding a larger number of satellites and more sophisticated technology for military applications compared to India. Joshi further notes an increase in India's space activities but ultimately concludes that — despite its ASAT test — the country lacks capabilities for effectively securing its assets in space given the more advanced and nuanced requirements of modern warfare.

Despite limitations, New Delhi's recent realism in the space sector has now firmly taken hold given the rise of the COVID-19 pandemic, which saw international opinion sour against Beijing — leading to a potential for migration of global STI investment away from China to India. China's own tactics of attempting to militarily encircle India along the contested boundary between the two states amidst the COVID-19 pandemic since June 2020 have further cemented New Delhi's resolve against an aggressive Beijing. Given the advent of a broader consensus within democratic powers to focus on maintaining a rules-based international order to ensure a free and open Indo-Pacific region, India — with both its public and private sector space organizations — stands to increasingly rely on Space Diplomacy to ensure not only its own national interest but common security of its strategic partners (Giri 2021: 70-75).

Space Technology, India's State Interests and the International System

India has historically taken active steps to address global challenges being faced by humanity in the domain of outer space, such as militarization of space. India was a part of the *Committee on the Peaceful Uses of Outer Space* at the United Nations in 1958, which attained permanent status in 1959. New Delhi also contributed actively to the formulation of the Outer Space Treaty, which came to fore in 1967 — barring the placement of weapons of mass destruction in outer space (Reddy 2017: 172-174). Rao (1968: 1-2)— speaking on behalf of India in his address to the *International Law and Co-operation Session of the 19th International Astronautical Congress* held on 15 October 1968 in New York — stressed India's position of space being reserved purely for pacific efforts meant for the common benefit of humanity. Rao (1968: 3) noted that though the US and USSR appeared to retain their dominance in terms of outer space technology in the near future, the possibility of new states entering the field could not be discounted. Rao (1968: 4) noted with alarm that the Outer Space Treaty of 1967 did not include a clause for reservation of outer space for peaceful activities. Rao (1968: 4-5) further noted a 'singular lack of enthusiasm' among great powers for making timely efforts to delimit the boundary between airspace and outer space.

Prior to its rise, India had consistently sought to align its space policies to match the consensus in the international system and had itself played a role in shaping space mechanisms of global significance such as the Outer Space Treaty (OST), 1967; Rescue Agreement, 1968; the Liability Convention, 1972; and the Registration Convention, 1974 (Lele 2016: 128). India had pursued Space Diplomacy in its national interest since the inception of its space programme and had further lent its support to organizations meant to address global issues in the realm of outer space such as the UN Office of Outer Space Affairs (UNOOSA) and the UN Committee on the Peaceful Uses of Outer Space (COPUOS). India sought UN engagement in the domain of outer space to both learn from established space powers and lend its own expertise to fellow states from the Global South. For example, India embarked on training personnel from the Global South and sharing the benefits of its space

programme with its counterparts in the developing world under the auspices of the UN as early as 1982 (Rajagopalan 2017: 378-379).

India's steadfast addressal of global space issues over the decades has included the country aligning itself with core commitments made under the auspices of the UN such as the Principles Relating to Remote Sensing of the Earth from Outer Space, 1986; the Principles Relevant to the Use of Nuclear Power Sources in Outer Space, 1992; and the Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries, 1996 (Lele 2016: 128).

Even after its rise, New Delhi continued to play an active role in shaping the space regulations and mechanisms for cooperation and conduct in international system. India is a member of the Inter-Agency Space Debris Coordination Committee (IADC) and co-sponsored the UNGA resolution 68/29 on Prevention of an Arms Race in Outer Space (PAROS). India further engaged with the EU for finalizing the EU sponsored proposal for *International Code of Conduct* (ICOC) (Lele 2016: 128).

In the 21st Century, Space Diplomacy emerged as a potent tool for Indian foreign policy as the country's space technology helped build ties not only with the Global South but with the developed states in the international system. Early efforts at maintaining self-reliance have led the country to secure a significant level of strategic autonomy in its space policy. India's abilities in the field of space technology have also been matched by an intention to share the benefits of its space programme with its counterparts from the Global South, and this has granted legitimacy to the notion of India's rise (Reddy 2017: 172-174).

Bagla (2019) notes that the Indian Chandrayaan-I project had begun to take shape in 2004-05, at a time when the Indo-US Civilian Nuclear Deal had yet to reach its final stages. India still faced western technology denials and sanctions led by the US. However, India agreed to take abroad foreign payloads abroad its first lunar mission — and this resulted in the US and EU seeking to place their space technology assets abroad the Indian lunar probe. This show of cooperation — in which India did not charge any state or political entity for having

launched its satellites into the lunar orbit — was seen as a definitive diplomatic outreach by Bagla.

Bagla (2019) cites Dr. Carle Pieters as having stated that her Moon Minerology Mapper was languishing in the US before India agreed to launch it as a part of the Chandrayaan-I project. The placing of American assets abroad an Indian launch would lead to the discovery of water molecules on the moon's surface — one of the most significant advances in scientific knowledge in the 21st Century on which Indian and American scientists jointly published the research outcomes. With the launch of India's Chandrayaan-II project in 2019, the pivotal search for water on an extra-terrestrial heavenly body would lead to further cooperation between NASA and ISRO with India allocating space for NASA's advanced laser-range finder without any charges to the American taxpayer.

In the 21st Century, India has enjoyed a robust partnership in space with its strategic partner France. This partnership manifests in joint missions such as the Megha-Tropiques — launched onboard the Indian PSLV system on 12 October 2011 — which is a joint effort between ISRO and France's Centre National d'Etudes Spatiales (CNES) to study the water and energy cycles in the tropical convective oceano-atmospheric sphere. In the mission, ISRO provided the Microwave Analysis and Detection of Rain and Atmospheric Structures (MADRAS) imaging radiometer while CNES provided the Sounder for Probing Vertical Profiles of Humidity (SAPHIR) microwave sounding radiometer and the Scanner for Radiation Budget (ScaRaB) wide-band radiometer. Data from this mission also contributes to NASA's Global Precipitation Measurements (GPM) cooperation program (Blamont 2017: 219-220).

Another joint Indo-French mission of global significance is the Satellite with ARgos and ALtiKa (SARAL) — launched onboard the Indian PSLV system on 25 February 2013. This effort is meant for altimetric purposes to study the proportions of water-based resources of Earth. The Indian launch included the French Argos-3 data collection system and an ALtiKa (Ka band) altimeter as well as a Doppler Orbitography and Radio-positioning Integrated by Satellite (DORIS) system meant for orbit determination through a ground station (Blamont 2017: 221). Blamont (2017: 221) notes that 'SARAL-ALtiKa has been a pertinent precursor for the future NASA-CNES altimeter mission SWAT.'

In 2018, both ISRO and CNES asserted that the two sides 'would jointly address the global challenges like climate change through joint missions, advanced processing tools and also mobilizing expertise and resources from other space-faring nations. In particular, both sides will pursue their cooperation for climate monitoring on the joint missions Megha-Tropiques and Saral-ALtiKa, the ongoing studies of the Trishna satellite for land infrared monitoring and the Oceansat3-Argos mission'. Both sides also sought to jointly address international challenges of common concern through multilateral forums, including the UN, to ensure the sustainable usage of space (Government of France and the Government of India 2018).

Beyond satellite launches, ground support and support via its own satellites — India has also relied on more traditional elements of international space cooperation such as organizing international meetings and symposia to deliberate on devising best practices for addressing global challenges through space technology. As a representative example, the country hosted the 10th edition of the *Asia Pacific Remote Sensing Symposium* in New Delhi between 4-7 April 2016, which saw the participation of 15 states in a bid to deliberate on strategies to ensure enhanced international coordination between various space agencies to address issues such as disaster management and climate change. As a part of the event, ISRO and CNES organized a meeting of nine international Space Agency Heads and senior representatives on 3 April 2016 — which included a reiteration of support to jointly work together for effectively addressing climate change according to the 2015 United Nations Climate Change Conference (COP 21) framework reached in Paris, France (Department of Space, Indian Space Research Organization 2016).

India's role in addressing the global concerns on space has also invited attention from its core strategic partners. Samson (2017: 239-240) notes that — given the intentions and the capabilities of the two prominent spacefaring states — there exists a viable potential for India and the US to work together in multi-national forums such as the United Nations' Committee on the Peaceful Uses of Outer Space (COPUOS), meant to jointly address mutual concerns regarding the sustainable and peaceful usage of space.

India's Space Diplomacy meant for addressing global challenges includes active participation by ISRO in sharing data and expertise for natural disaster management on a global scale (Lele 2016: 125-129). Given a vast geography prone to a diverse range of natural and man-made

disasters, ISRO maintains a series of satellites dedicated to disaster management and earth observation applications — and by 2020, these are EOS-01, RISAT-2BR1 and RISAT-2B. In contemporary times, ISRO further operates the INSAT-3DR and INSAT-3D satellites meant for addressing climate, environment and disaster management issues. Assets such as these grant New Delhi with credible capabilities to address disaster management and mitigation both within and outside its borders through dissemination of information, experience and best practices. ISRO is a signatory to the *Space and Major Disasters* charter which enables it to support other authorized members in their disaster management efforts. ISRO is also active under Asia-Pacific Regional Space Agency Forum (APRSAF) led *Sentinel Asia* programme for disaster management in the region. Disaster management efforts under the auspices of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), United Nations Office for Outer Space Affairs (UNOOSA) and BIMSTEC are further supported by ISRO — which lent assistance to as many as 18 foreign countries through 22 disasters in the year 2018 (Department of Space, Indian Space Research Organization 2020b; 2020c; 2020d; 2020e; 2020f). Bagla (2019) further situates India's advances in space technology as being of utility to World Meteorological Organization and to other friendly states in the Indo-Pacific for natural disaster management purposes.

Besides providing support through its satellites, India's launch vehicles also play a role in launching satellites meant for disaster management for its strategic partners. On 16 September 2018, India launched UK's S1-4 and Nova SAR satellites abroad its PSLV-C42 mission. Both satellites enable London to monitor its disaster mitigation and management efforts (UNOOSA 2020). During the ongoing COVID-19 pandemic, ISRO assisted Indian national efforts at tracking the impact of the virus through geospatial technology under its *Bhuvan* geoportal. Decision-makers at a central and state level in India were able to track the impact of the pandemic through the *Bhuvan-COVID-19* system — aiding management and relief efforts (Department of Space, Indian Space Research Organization 2020a). The extent to which India has shared this expertise with its neighbors and other states in the international system is yet to emerge. However, New Delhi has certainly abided by its commitments to launch satellites for its international customers through the pandemic by launching nine satellites from the US, Lithuania and Luxembourg in November 2020 abroad

its PSLV-C49 mission — further cementing its reputation as a credible international provider of launch technology even amidst such a pressing shock to the international system as the COVID-19 pandemic (Press Trust of India 2020b).

Lele (2019a) contends that India's Space Diplomacy to answer global challenges includes New Delhi being a signatory to COPUOS, PAROS, Outer Space Treaty and Moon Treaty 2. This is in contrast to India's strategic stance in the nuclear sphere, where the country has yet to sign the NPT. Lele also notes that, given the large number of states that require assistance for developing their space programme, India has to be more proactive in its Space Diplomacy. Lele asserts that many states have modest aspirations in the space, and this leads to other states such as the PRC stepping in to provide assistance, leading to narrowing the window of opportunity for India to emerge as the pre-eminent provider of space technology. Per Lele, India's market share in the global space market remains less than 3%. India has also delayed the privatization of space in the country, and is only yet beginning to wake up for it.

Indian Space Diplomacy also has to deal with an external environment which might be free from the machinations of a select few global powers but is now having to reconcile with the ambitions of dozens of nation-states in addition to non-state actors. This crowding of stakeholders in the field of outer space technology has drastically complicated notions of ideal and harmonious global cooperation (Rajagopalan 2017: 371-373). Outer space is further perceived globally as an unlimited commodity — which gives rise to challenges such as space debris, allocation of spectrum, and interference in radio-frequency. Furthermore, space-faring states have their own national visions and this has led to a lack of international consensus for addressing common issues and challenges in terms of global cooperation (Rajagopalan 2017: 372-375).

Space Technology and Domestic Dynamics in the Indian Environment

Since its inception, India's space programme has been guided by a powerful political motivation of pursuing international prestige by seeking to situate the country as a high-achieving state in terms of space S&T in the international system. The Indian space programme also caters to the country's domestic constituency, acting as a source capable of inducing a potent rise in national confidence. The country's more important space launches are traditionally marked with a presence of senior political leaders, given the prestige and popularity enjoyed domestically by its space programme (Mistry 1998: 161, 172). Lele (2019a) notes that the Indian space programme — along with the country's nuclear programme— continues to enjoy bipartisan support from its political class in the 21st Century. This has translated into significant funding for the space programme from the leadership of a developing India. Since the mid-1980s, India's space programme has also delivered dividends by aiding national development, and this has bolstered the 'image of the space community in the eyes of the politicians', resulting in favorable budgetary allocations according to Lele.

Indian leaders have thus sought to portray the country's ISRO-led space technology advances as representative symbols of progress both domestically and internationally. In 1984 — in a broadcast meant to articulate national progress made during her four years in power — Indian PM Indira Gandhi (1984a: 11-13) noted that the India had to upgrade its production structure to absorb latest technologies if the country was to keep up with the rapid global advancement in technology. Gandhi (1984a: 11-13) held that India's space and nuclear programmes— both of which had seen a significant measure of success by the time of the broadcast— were intended to cater to the requirements of the ordinary citizens of the country. In the same year, while addressing the *Non-Aligned Information Ministers' Conference* in Jakarta, Indira Gandhi (1984b: 13-14) stated that 'The space age has revolutionised the technology of information. Non-Aligned countries must not be left behind, for failure to keep up will only make us more dependent. The space programme in India is finding new ways of using satellites for speedier communications in remote areas, for mass

education and to provide a variety of information directly relevant to the lives of our people. I am sure other developing countries are also devising plans to use new processes of communication to support the nation-building process.'

By the mid 1980s, India's ISRO-led space programme had gained global recognition as a core exemplar of India's S&T. While in New Delhi to sign the protocol of the *Fifth Session of the Indo-Swedish Joint Commission*, Mats Hellstrom — Sweden's Minister of Foreign Trade — remarked in February 1984 that he was impressed with India's S&T capabilities in fields such as space technology and biotechnology (Press Information Bureau, Government of India 1984b: 78-81). Brazil's foreign minister Ramiro Saraiva Guerriero — during his state visit to India on 6 March 1984 — situated India's space programme as a 'spectacular' success that had given the country assets as the INSAT (1-B) satellite and hoped for closer S&T cooperation between India and Brazil (Guerriero 1984: 94-98). Japan's PM Yasuhiro Nakasone — in his address to Indian MPs in New Delhi, 4 May 1984 — also remarked that 'India has also made many noteworthy achievements in such advanced high-technology fields as space development and Antarctic exploration' (Nakasone 1984: 178-183).

By the 1980s, Indian diplomats sought to showcase the country's S&T achievements both in the fields of nuclear and space technologies through multimedia, lectures and seminars in foreign events meant to advance its soft power — with a representative example being the *Year of India* in France, 1985-1986 (Press Information Bureau, Government of India 1984a: 106-109). By the mid-1990s, India showcased its achievements in space technology to dignitaries from other states. In one such case, the Ministry of External Affairs, Government of India (1996: 198-199) — on the occasion of the visit of South Africa's Deputy President Thabo Mbeki between 3-7 December 1996 — stated that Deputy President Mbeki will 'also obtain a glimpse of India's achievements in the area of science and technology when he visits the Indian Space Research Organisation (ISRO)' in Bangalore.

The contribution of the Indian space programme towards achieving the country's national objectives — and for bringing New Delhi a measure of domestic and international prestige — has further been evident at the highest levels of leadership in India through the 21st Century across various administrations. Indian PM Atal Bihari Vajpayee — in his 5 September 2002 address at Sriharikota, in which he witnessed the renaming of

the *Sriharikota Satellite Launch Centre* to *Satish Dhawan Space Centre* — remarked that the country's space programme had faced adverse circumstances induced by conditions imposed by international technology denial regimes but had yet progressed and maintained the primacy of its civilian nature. The Indian PM further recognized the efforts of the country's space scientists and technologists to then express pride in the fact that the rising power had joined a select club of half a dozen states in the international system with major spacefaring capabilities. In a telling sign of things to come, PM Vajpayee also noted that India was now in a position to 'offer our satellite launch services for satellites from around the world' (Vajpayee 2002).

In his inaugural address to the 90th session of the Indian Science Congress, PM Vajpayee (2003) singled out Dr. Krishnaswamy Kasturirangan — the then incumbent head of ISRO who also served as the General President of the 90th session of the Indian Science Congress — as being a scientist whose presence brings reassurance representative of ISRO. PM Vajpayee (2003) remarked that 'the nation is proud of the achievements of our Space Programme and of your leadership to it, Dr. Kasturirangan.' Vajpayee (2003) further remarked that 'Our space programme has earned India global recognition. About a year ago, it demonstrated India's capability to launch a satellite into geostationary orbit with our own launch vehicles. I am confident that it will soar higher in 2003 and in the years ahead.'

In his 21 September 2005 address to the Scientists at the Satish Dhawan Space Centre, Indian PM Manmohan Singh noted the consistently successful nature of India's satellite launches and went on to express his pride in ISRO's progress in the space sector despite a history of international technology denial. PM Singh noted that ISRO had begun to launch foreign satellites in greater numbers and had established itself as a global leader in space technology while boasting a stellar history of non-proliferation that deserved greater recognition both domestically and internationally (Singh 2005).

PM Singh further noted the presence of competent infrastructure in India that stood to benefit both the country and its international partners. The Indian PM stated that the Chandrayaan-I mission stood to contribute to the international profile of the Indian space programme, and noted the enhanced interest from other states in the international system in engaging with the country in the space sector. Singh (2005) reiterated India's commitment

to international space cooperation for addressing global issues and also situated the country's quest for self-reliance in the space sector for addressing national needs as being the core motivation for the national space programme.

In his address *The World Sees a New India* — delivered on 6 September 2018 — the Indian PM Narendra Modi also sought to publicly communicate the country's achievements under his administration. Modi (2018) asserted that 'Another emerging area, where India is firmly creating a technological niche, is its space programme. With a team of world-class scientists and engineers, it has become a pioneer in space industry. ISRO has set a world record by successfully launching 104 satellites in a single flight, out of which 101 co-passenger satellites carried were international customer satellites from USA, Netherlands, Switzerland, Israel, Kazakhstan and UAE. India’s indigenous global navigation system has been set in place with the successful launch of IRNSS-1G. With this, India has joined the elite list of countries with their own satellite navigation system.'

Lele (2016: 131) writes that 'Science and technology engagement is one cornerstone of international diplomacy' and further goes on to observe that 'consciously or unconsciously, India is continuing to derive soft-power benefits from its various achievements in the space area.' Bagla (2019) further connects India's advances in space such as Mangalyaan with nationalism and national pride. Bagla visualizes India 'asserting itself on the world stage using high-quality satellites and launchers which Indians have total control over.'

By 2015, variants of India's PSLV had launched a total of 84 satellites, with 51 originating from outside India. These launches predictably carried satellites from India's partners from the Global South such as Indonesia and Argentina but the bulk of the satellites launched by India during this period came from the Global North, with states such as the US, UK, Canada, Germany, France, Japan etc. repeatedly availing ISRO's launch services for launching critical space satellites in their own national interest (Department of Space, Indian Space Research Organization 2019). Between 2015 to 2019, ISRO had also generated 12.45 billion INR by commercially launching foreign satellites from 26 states. By FY 2018-19, ISRO's annual revenue through launching foreign space assets via its PSLV launch system had increased to 3.24 billion INR ahead of over 2.32 billion INR in FY 2017-18. Between 1999 and 2019, India's workhorse PSLV had launched a net total of 319 foreign satellites (Singh, S. 2019).

However, in the 21st Century, the traditional prestige associated with ISRO — as a privileged, state-run herald of India's space technology — in New Delhi might yield mixed results for the country's overall space sector and, consequently its potential to carry out Space Diplomacy. To realize the potential of India's space sector, Sood (2019) acknowledges the limitations of ISRO and states that: 'Private sector investment is critical, for which a suitable policy environment needs to be created. There is a growing realisation that national legislation is needed to ensure overall growth of the space sector. The draft *Space Activities Bill* introduced in 2017 has lapsed and the government now has an opportunity to give priority to a new Bill that can be welcomed by the private sector, both the larger players and the start-ups alike.'

Sood (2019) notes the synonymity of India's space milestones with ISRO — particularly the success of the PSLV programme — but also acknowledges that ISRO's GSLV programme, including its latest avatars such as the MK-III, pales in comparison to its alternatives in the international system such as the French *Ariane 5* in terms of payload capacity and launch frequency. Sood further notes ISRO's ties to India's Public Sector Undertakings such as Hindustan Aeronautics Limited (HAL), Mishra Dhatu Nigam Limited and Bharat Electronics Limited (BHEL). Sood stresses upon ISRO's traditionally low dependency on private sector entities — with the bulk of the vendors being relegated to Tier 2-3 category with notable exceptions being Larsen and Toubro, Godrej and Walchandnagar Industries. Sood situates India's ISRO-led space sector's share to amount to about 2% of the global space market.

Noting the gap between Indian space sector's potential and capability — Sood (2019) states that a new space law in India is required, and its ambition should be to increase the country's market share in the global space sector to ten percent in ten years, to be ideally actualized through a robust working relationship between ISRO, the Indian private sector and the New Space element. Rajagopalan (2019b) notes that 'collaborating with the private sector has not been an easy move for the government-funded (and managed) ISRO' and 'bureaucratic resistance to helping India’s private space enterprises, even from within the ISRO, means the organization still has not succeeded in transferring the PSLV to the private sector.' Rajagopalan does note GoI efforts to facilitate the role of the private sector in India's space efforts — with emphasis on the recently approved public sector enterprise *NewSpace India*

Limited (NSIL), established in 2019, meant to enable technology transfer from ISRO to the private sector and further pave way for the expansion of the space sector through effective commercialization. However, Rajagopalan also points towards India's limited competitive advantage in the space sector vis-a-vis states such as China, and towards the rise of private sectors competitors in states such as the US, to assert that New Delhi has to take further steps to enable the rise of its private space sector without undue apprehensions that it might eclipse state-run efforts made by organizations such as ISRO (Rajagopalan 2019b).

During the ongoing COVID-19 pandemic, two important developments indicating the GoI's increased focus on enabling a greater role for the private sector in space activities came to fore. The first was the establishment of the Indian National Space Promotion and Authorization Centre (IN-SPACe) in May 2020. IN-SPACe seeks to simplify private sector access to ISRO's space infrastructure for giving rise to greater innovation in space technology. It also seeks to enable increased private sector involvement in the space sector through favorable participation policies, regulations and guidelines (Giri 2021: 69). Secondly, the Spacecom Policy 2020 also seeks to 'promote increased participation of commercial Indian industry to provide space based communications both within the country and outside' and further to create an enabling environment for the Indian private sector for establishing and operating communication assets in space. However, the Department of Space, GoI — through the same policy — also seeks to develop space communication assets for national purposes that cannot be developed by the private sector due to financial or national security concerns (Department of Space, Government of India 2020: 1-2). This presents a mixed but evolving picture for non-traditional participation in India's space sector.

Chapter Summary

Since independence, India has itself relied on multiple sources of space technology to aid its own national objectives but — given its own steady and deliberate advances in the field — has also emerged as a state with demonstrable competence worthy of aiding other states and multilateral organizations in the international system in the 21st Century. India's space

programme was — and continues to be — civilian-led but the country has further begun to demonstrate a will towards achieving capabilities beyond credible minimum deterrence even in the field of military space technology during recent decades.

India continues to utilize its space assets to reach out to its partners both in the Global South and the Global North — across diverse regions extending well beyond its South Asian neighborhood — to address common needs and to also raise its own profile in the comity of nations the process. The fact that space technology is still elusive for practical pursuit for most states in the international system is still an advantage for India in its ambitions to build closer inter-state ties by utilizing its space S&T. But that there are other competing states in the international system such as China that provide for credible alternatives to India's potential provision of space technology is also a factor that should concern New Delhi's future strategy.

That India is a democracy with increasingly converging state interests with other global democracies such as the US, Japan and the EU has lent an advantage to its Space Diplomacy. However — even in the 21st Century — the Indian space programme has become synonymous with its government-led ISRO at a time where privatization of the space sector is a major indicator of overall progress in the same sector among other countries which enjoy a free-market economy, such as the US.

To credibly advance in the space sector, India has to focus beyond the traditional prestige associated with its own state-sponsored space programmme led by ISRO to create a more meaningful supply chain ideally comprising of private sector actors from both within and beyond the country's geographical confines. Until then, India's space programme — as led primarily by is premier space agency ISRO — will continue to deliver credible but increasingly diminishing results not amounting to even a portion the potential of which the rising power might be capable of achieving in the space sector. And this will create consequent constraints for its Space Diplomacy.

India's adherence to maintaining abiding relations with both the Russian Federation and states averse to its international policies — such as the US and its allies — may further have a bearing on its future as an independent state capable of pursuing Space Diplomacy while

adhering to its cherished principle of *strategic autonomy* in foreign policy. India will have to ensure that its Russian-origin systems have harmony with other systems that it has in its national quiver of space technology assets without impinging on its other international commitments. This may further cause complications for the rising power in the 21st Century in terms of interoperability and technology access.

Chapter 5: A Critical Assessment of India's S&T Diplomacy as an Instrument of Foreign Policy in the 21st Century

This chapter offers an assessment of India's S&T Diplomacy as an instrument of the rising power's foreign policy in the contemporary century. The issues that impede India's S&T Diplomacy from optimally achieving foreign policy objectives are analyzed, as are the opportunities that enable the country to pursue S&T Diplomacy in service of its foreign policy objectives and state interests. The S&T component of India's development assistance engagement and the country's Space Diplomacy — as well as New Delhi's broader S&T Diplomacy designs — are assessed using *independent critical analysis* after a careful examination of the evidence received from the chapters above. Finally, recommendations and conclusion are provided based on existing evidence.

India's S&T Diplomacy in Service of National Interest

Both India's S&T institutions and policies have evolved given the country's rise. From the Scientific Advisory Committees established by 1948 to the establishment of the Office of the Principal Scientific Adviser to the Government of India in 1999 to the rise of MEA's New Emerging & Strategic Technologies Division in the 21st Century, the institutions that impact the country's S&T Diplomacy have grown in *both* numbers and influence. The difference in terms of ambition between the Scientific Policy Resolution of 1958 and the Draft Science, Technology, and Innovation Policy of 2020 is a testament to the country's rise in the international system as a more-confident emerging power willing to engage other states and entities for addressing its own state interests.

However, institutions are run and policies are implemented by human beings. New Delhi's management to competently assimilate credible human resources from both within and outside its geographical confines to address its national objectives remains circumspect for its S&T Diplomacy. India's S&T professionals might not yet be in a state to fully grasp the

impact of their own work on the country's foreign policy and its state and foreign policy functionaries might not yet be in a full grasp of how S&T impacts state interests. These issues translate to a less than optimal training and charter accorded to the country's Science Counselors, and also might impact New Delhi's engagement with a vast Indian diaspora that specializes in S&T — which comprises of a competent workforce that migrated away from the country itself in search of more optimal working conditions elsewhere.

Despite speech invocations and meagre policy mechanisms to attract S&T-inclined diaspora back to India, and despite honors conferred to the more successful members of the country's S&T diaspora — the actual progress of engaging with the diaspora has yet to emerge in any clearly discernable manner for India's national interest. Furthermore, many of the country's own universities have yet to meet global research standards or even be connected to the Indian innovation system itself — impeding both the country's national progress and global competitiveness.

The country's S&T mix is marked by the primacy of the central government in terms of expenditure and authority — with states, universities and the private sector yet to be fully enabled by the overall Indian system to reach their maximum potential. However, things are changing with the states now enabled to engage other entities in the international system through the MEA's States Division. New Delhi's Skill India, Startup India, Digital India and Make in India initiatives have sought to attract the country's private sector participation in core areas of S&T. India was able to rise as an early responder to the ongoing COVID-19 pandemic primarily through the advances of its private sector entities — most notably the Serum Institute of India and Bharat Biotech.

A heady mix of domestic factors consisting of elements such as multiple political actors, a federal system, bureaucratism, and labyrinthine laws and regulations have impacted India's capacity to both absorb and deliver S&T progress within and outside its geographical confines even in cases of clear agreements reached with its strategic partners in the international system. Despite turbulence and imperfections given its chaotic domestic dynamics, the rising power has still managed to emerge as a credible source of S&T for its many partners in the international system — and as a state that has further gone the distance

to answer to global issues such as climate change and the early phase of the COVID-19 pandemic in the 21st Century despite existing limitations. India's Neighbourhood First, Act East, Indo-Pacific, Think West and pro-Africa foreign policy calculations have consistently held firm in its S&T Diplomacy throughout the 21st Century albeit in varying degrees.

The notion that scientific interactions can exert a profound stabilizing influence between countries with deeply discordant ideologies and political systems[58] is disproven in India's case. India — as an aspiring power committed to non alignment — did manage to secure some S&T cooperation from both the US and the USSR in its national interest soon after its independence from the British Empire in 1947. However, its concerns regarding the first Chinese nuclear weapons explosion in 1964 were ignored by Washington, DC and when the country attempted its own nuclear test a decade later it came under US-led international sanctions itself. The country's space programme also faced MTCR sanctions during the 20th Century, also initiated by a US averse to India's rise.

India's experience in terms of S&T engagement with the international system has been closer to the realist line. Given concerns such as China's aggressive rise — the US since 2004 enabled the rise of India and also its now-notable space and nuclear programmes. China and Pakistan have been *constant* rivals of the rising power in Asia and South Asia respectively in terms of technology, with Beijing seeking to successfully deny New Delhi an entry to the Nuclear Suppliers Group (NSG) till date and enabling Islamabad to pursue a measure of parity with India in terms of nuclear technology. Despite China's moves to limit India's entry to the NSG — the Rising Power has not only gained an export regulation waiver from the NSG since 2008 but has also entered other key multilateral export control regimes such as the Wassenaar Arrangement, the Australia Group and Missile Technology Control Regime as full-member in the 21st Century. New Delhi further stands in opposition to the Beijing-led Belt and Road Initiative and is firmly embedded into the Quad-led Indo-Pacific strategy — meant to ensure a free and open Indo-Pacific region devoid of Chinese hegemony.

[58] Articulated originally by Fedoroff (2009: 9).

Rising India's strategic autonomy — a principle borne out of non-alignment to enable national progress without being mired down in external inter-state rivalries during the previous century — has held by the time of writing this thesis with the country fielding extensive S&T Diplomacy with both Russia and the US, two of its core strategic partners who also rival each other in the international system. India also fields strategic S&T cooperation with Israel, Iran and the Gulf states — who yet have rivaling foreign policy calculations in West Asia. Given the flux in the international system New Delhi's core calculations might stand to be revised.

21st Century India has further managed to enter high-impact global S&T collaborations such as the European Organization for Nuclear Research — of which it is an associate member and the International Thermonuclear Experimental Reactor project, of which it is a full-member. The rising power has also led international initiatives such as the International Solar Alliance and the Coalition for Disaster Resilient Infrastructure to answer pressing global issues such as clean energy and risk-mitigation in developing sustainable infrastructure. These engagements stand to partially shape the country's nation-brand depending upon its policies the extent of participation.

The nuts and bolts of India's S&T Diplomacy as they stand now might continue to confound scholars of international relations for the foreseeable future. The country has yet to fully address its basic defence technology needs — a feat ably managed by many of its more modest counterparts in the international system — but was also able to successfully send a space probe to Mars in the very first attempt. New Delhi has invoked S&T Diplomacy in its most exalted policy and speech summiting to the offices of both its President and Prime Minister — but the concept has yet to fully seep through even among its S&T and foreign policy elite. India has credible research and input on the subject of S&T Diplomacy but can still not manage to field a credible corps of Science Counselors along the lines of its other specialized services.

However, India has still come a long way from an aspiring power once holding to its meagre resources and dependent on the limited attention of the many powers in the international system to a rising power which addresses its S&T Diplomacy calculations with an enviable

range of strategic partners, many of whom might rival each other in the international system but still find strategic value in S&T cooperation with a resurgent New Delhi. India's S&T Diplomacy has thus both arrived and has yet to realize its full potential. This muted condition has thus far been under-acknowledged in Science Diplomacy studies.

International Engagement in National Interest: S&T and Development Cooperation

In terms of development cooperation, India has come a long way from navigating the dynamics of a bipolar international system through the 20th Century as an aspiring power to more confidently addressing its state interests in conjunction with its now many strategic partners in the 21st Century international system. India's development cooperation programme has largely held firm in its core calculations of non-interference and mutual respect for territorial integrity and sovereignty of partner states. Its core mechanisms for addressing development cooperation needs of its partners in the international system such as the ITEC programme have become firmly ingrained in its foreign policy, and the country now leads new development cooperation initiatives in the international system such as the International Solar Alliance and the Coalition for Disaster Resilient Infrastructure.

New Delhi now fields four Development Partnership Administrations through its MEA, each under a high-functionary of its elite Indian Foreign Services — and a States Division to ensure development cooperation progress at both central and state levels. India further ties a major portion of its outbound development cooperation design to goods and services from within the country — ensuring the role of the private sector for addressing challenges such as the ongoing COVID-19 pandemic in the process.

As a rising power, India accesses global advances made in various fields of S&T outside its borders by its strategic partners, chiefly the US, EU — including member states such as France and Germany — Israel, Russia, the UK, Singapore, UAE, Australia, Canada and South Korea for meeting its national S&T requirements on a bilateral basis. At a national level, India

also relies on a select group of multilateral organizations — including the ADB, EIB, IBRD, IDA and the Global Fund — to support its various ongoing national development programmes in the 21st Century. Thus the country — in the contemporary era — can thus far be safely situated as one which acts *both* as a source of development assistance but also a destination for development cooperation in the international system.

In addition to pursuing development diplomacy on an inter-state level on a bilateral basis, India aids the functioning of multilateral organizations such as the Asian Development Fund, African Development Fund and the United Nations Organization through allocation of financial contributions. The country also seeks to deliver development assistance to states in the Global South through triangular cooperation in conjunction with its strategic partners — such as Portugal, Russia, UAE, Israel, Netherlands, Singapore, South Korea, the US, the UK and Japan etc. New Delhi further pursues its South-South Cooperation strategy by partnering with international multilateral organizations.

India's quest for regional primacy in South Asia — now morphed to its Neighborhood First foreign policy strategy is served by strategic S&T development cooperation in the region. With the exception of Pakistan, India has extended both Lines of Credit and S&T cooperation to all of its neighbors in South Asia, emerging as a significant provider of development cooperation in the region. India's core calculations also come with an intention to check China's influence in states such as Maldives and Nepal.

India's Look East policy morphed into the Act East component of its foreign policy design under the first Narendra Modi administration since 2014. The component also has a strategic S&T element meant for providing development cooperation, which might overlap with New Delhi's Indo-Pacific strategy in terms of emerging projects such as the Asia Africa Growth Corridor — to be implemented in conjunction with its strategic partner Japan to check China's growing influence in the international system. Both states also support the India-Japan Act East Forum since 2017. However, among all of India's S&T Diplomacy related development cooperation policies, the Act East component requires more resources and focus for delivering visible outcomes.

The Indo-Pacific element has recently taken center-stage in India's development cooperation strategy — with a quadrilateral grouping comprising of India, Japan, the US and Australia striving to address shared global challenges such as the ongoing COVID-19 pandemic in their joint interest by seeking to ensure timely and effective vaccine provision to other states to impede the ongoing disruption and shock to the international system. India's Indo-Pacific foreign policy element is also meant to check rival China's own prime development cooperation initiative that manifests in the shape of Belt and Road initiative, which directly challenges its existing territorial claims over Pakistan administered Kashmir.

Another policy that has emerged since the advent of the first Narendra Modi administration in India since 2014 is the Think West policy — which has seen enhanced strategic S&T development cooperation between India and West Asia during recent times. Since 2015, India and UAE maintain a bilateral infrastructure investment fund — and since 2018 both states seek to work towards energy exploration in third countries. India's S&T cooperation with Israel exists in multiple areas of development cooperation including the *Strategic Partnership in Water and Agriculture*. UAE has supported India's strategic crude oil reserve calculations since 2017. Both UAE and Saudi Arabia cooperate with India for developing its Ratnagiri Refinery and Petrochemicals Limited project. Despite the Taliban takeover in Afghanistan, India remains invested in the the Chabahar Port Project in Iran. Many of India's strategic partners in West Asia have rivaling calculations against their fellow states from the region, and the extent to which New Delhi can ensure cooperation in the future has yet to fully emerge.

India's adherence to its time-tested principle of strategic autonomy yet holds firm in terms of its development cooperation design even given its rise in the international system during the 21st Century. For one instance, its abiding strategic partnership with Russia — despite growing strategic convergence with both the US and the EU — has yet held firm. India's state of Uttar Pradesh is now set to manufacture AK-203 assault rifles for its army given Russian support. The Rising Power extended a Line of Credit worth one billion USD in 2019 to Moscow for developing the Russian Far-East.

India's S&T-based development cooperation addresses key global areas such as civilian nuclear technology through inputs, hardware and human resource development in partnership with multilateral organizations such as OECD and IAEA. New Delhi cooperates on bilateral, triangular and multilateral levels with its many partners in the international system to address issues related to global food security. Despite a traditional reliance on conventional sources of energy to address its national needs, India is a signatory to the Paris Agreement on climate change. The country's international commitment to clean energy despite the existence of a national energy mix that still relies on conventional sources might prove difficult to maintain at least in the near future.

Then there are issues of delivery. In an interview to The Hindu's Suhasini Haider as a part of press engagement during his April 2018 state visit to India, Nepal's Prime Minister Khadga Prasad Sharma Oli — in response to a question on whether Kathmandu would prefer completion of existing development projects aided by India before signing more such agreements with New Delhi — remarked that both sides wanted to 'improve our rate of commitments and delivery'. Oli stated that India's development cooperation projects in Nepal, such as the Pancheshwar and Mahakali hydropower programmes, had both reached a signing of bilateral agreement in 1996 but even after two decades both projects still awaited completion. Oli invoked his displeasure through a Sanskrit saying: 'If you have to give something, or do something, and if you don’t do it in time, then time itself will destroy its value' (Haider 2018).

Perhaps more troublingly, India also faces credibility issues even when it comes to managing development projects within the country's very own geographical confines. Both its South Asian University and Nalanda University projects — meant as potential exemplars of the country's soft power — fell victim to labyrinthine domestic procedural issues. India's extension of a one billion USD LoC to Mongolia in 2015 also came under fiery criticism from many of its political parties. Even its Mumbai-Ahmedabad rail project — aided on a favorable basis by the Shinzo Abe administration in Japan — became mired in domestic political and procedural issues.

That the rising power has managed to emerge as a leading provider of development cooperation in the 21st Century international system — led primarily not by elements of either finance or military technology but rather those of civilian S&T — despite its turbulent domestic dynamics and uneven S&T mix is a remarkable achievement in its own right. Both India's inbound and outbound development cooperation designs continue to be led by the S&T component. The country stands to gain from a healthy budget for outbound development cooperation — to be ideally tied to Indian goods and services with primacy granted to its own private sector — and more participation of its states and union territories for enhancing its role in global development diplomacy.

Space Technology as an Instrument of Indian Diplomacy

The rise of India's space programme during the last century is a remarkable achievement its own right. That India — as a state with a colonial past and meagre national resources after its independence — committed itself to such a programme in its national interest despite its many limitations is both a testament to the commitment of the Nehru administration to scientific temper and the utilitarian vision of its scientist-administrators such as Homi J. Bhabha and Vikram Sarabhai.

20th Century India remains as a unique state from the Global South in which its scientist-administrators were able to compel its political leadership for allocating time, resources and attention for developing a space programme that would ultimately serve to aid the country's national efforts in such critical areas as communication, meteorology, maritime domain awareness, disaster mitigation and global navigation.

India's addressal of policies that guide its space technology has been both recent and very cautious. Its *Satellite Communication Policy* came as late as 1997 and its *Remote Sensing Data Policy* came as early as 2011. India's steady release of field-specific policies such as the *Spacecom Policy 2020* and the *Draft Humans in Space Policy for India, 2021* also serve to address its interests in specific areas slowly and deliberately at a time of the GoI's own

choosing — as does its establishment of new state organs such as NewSpace India Limited and Indian National Space Promotion and Authorization Centre.

The extent to which the country can continue to guide its space technology efforts given an absence of a declared national space policy still remains uncertain. India has come far from being a state which sought to learn from its more-advanced counterparts in the international system for gaining space technology to then address its own national needs such as survey of resources, broadcast of educational programmes and weather forecasting during the 20th Century. It now launches satellites of sensitive value for some its most technologically advanced strategic partners in the international system such as the US, the UK, Israel, Canada, Japan and EU states. Also, given the advent of the private sector in global space landscape, a declared Indian policy would perhaps serve to save the rising power from ad-hocism in the field of space technology.

India's Space Diplomacy has been marked with not idealist notions of benign cooperation but realist calculations made both in New Delhi and foreign capitals. Its space programme — for as long as it adhered to a purely civilian mandate — actually survived US-led sanctions that were put upon the country's nuclear programme in the aftermath of the 1974 Indian nuclear test. In fact, the US cooperated with India for giving rise to the SITE programme in the country — meant to broadcast educational content on a mass scale by 1975 through satellite technology. But as soon as India sought to acquire cryogenic engine technology from Russia, it came under MTCR sanctions in 1992.

Given growing convergence between the world's two largest democracies — ISRO would be freed from the US Department of Commerce Entity list in 2004, enabling the country's premiere space department to function without major hinderances in the international system. Given realist calculations, Pakistan has yet to accept India's gains from space technology given its own national security considerations and Sino-India space cooperation also remains thin. Given its rise, India is now a full member of the very same MTCR which sanctioned its space programme in 1992.

Both India's know-how and assets in space technology serve as credible components of its foreign policy. The country aided its strategic partner the US in its disaster management efforts through its Oceansat-2 satellite given the advent of Hurricane Sandy in 2012. The country is a signatory to Committee on the Peaceful Uses of Outer Space and Prevention of an Arms Race in Outer Space but still managed to fully demonstrate a strong Anti-Satellite (ASAT) capability in 2019 despite some muted protests from NASA and private sector entities.

India's space programme has been vital to answering global S&T issues such as the existence of water molecules beyond earth through its *Chandrayaan* probes. New Delhi continues to both impart space technology in the civilian domain to other states in the international system and gain from its many strategic partners in the 21st Century.

The country's strategic autonomy designs endure to its space programme in the 21st Century international system — with New Delhi fielding strategic space cooperation with both the US and Russia, and with Israel and the Gulf States. These powers in the international system have thus far seen value in cooperating with India despite New Delhi also maintaining close cooperation with their rivals. The extent to which India can cooperate with powers that rival each other in the international system is still to fully emerge.

India's space programme has been led by its prime state-run entity ISRO. And the entity has duly delivered credible outcomes for both the country's civilian and strategic needs. However, the global space landscape might be changing itself with the entry of multiple and competent private sector entities. India's stifling domestic environment that limits private sector participation in the space sector has resulted in the world's largest democracy occupying a market share of less than 3 percent in the global space sphere. The extent to which New Delhi can correct its course in this domain will be worth watching in the near future.

Recommendations for Optimal Conditions for the Role of S&T Diplomacy in Rising India's Foreign Policy in the 21st Century

International Relations community in India must develop a working knowledge of Science and Technology Diplomacy for practical actualization of the concept and to more effectively inform India's political elite on vital foreign policy decision-making in the 21st Century.

The concept of S&T Diplomacy has both existed and yet never been fully actualized to its potential by the policy-making elite in New Delhi since the inception of the modern Republic of India in 1947. Exceptions — such as scientist-administrators Vikram Sarabhai and Homi J. Bhabha, and political leaders such as Jawaharlal Nehru and Indira Gandhi — have also existed right until the contemporary Narendra Modi administration. In the 21st Century, the IFS and think tank levels in India have begun to show a greater awareness to discuss the role of the country's S&T Diplomacy to serve its national interests.

However, the process is still marred with a visible lack of specialization. New Delhi's S&T Diplomacy has been traditionally held hostage to a silo-mindset, compartmentalizing each S&T equation and often acting insufficiently upon it — such as Space Diplomacy with select states or S&T based development assistance focused on South Asia — without significantly considering benefits of a grand S&T Diplomacy strategy to be eventually set in motion in the wider international system for enabling India's rise.

There has to be a concerted effort at the IFS and the think-tank level to support the political class in its decision making. At present, RIS is the only the only major think-tank in New Delhi with specialization in the full tents of S&T Diplomacy, while other think-tanks offer specialization in select silos such as nuclear, development and Space Diplomacy. Thus, the Indian IR community has to step-up to claim its legitimate space as a reliable provider of informed and actionable analyses to its official and political class in the domain of S&T Diplomacy.

Science and Technology Diplomacy — as a utilitarian means to achieve foreign policy objectives meant to serve state interests — must be integrated with the Indian S&T system for

actualizing the potential of the principle. The Scientific and Technological community in India must be versed — at least notionally — about the country's foreign policy objectives, and ideally about the field of Science and Technology Diplomacy itself.

Terms such as Science Diplomacy, Technology Diplomacy — or the more versatile S&T Diplomacy — may be of recent origin. However, their practical application to serve state interests has constantly existed in New Delhi's calculations since the very inception of the modern Indian republic. This is evidenced in invocations, international agreements, policy frameworks and even in the more clandestine activities carried out by the Indian state to weaponize both its nuclear and space programmes to enable its rise. However, the level of integration that this aspect of diplomacy has traditionally enjoyed in the Indian foreign policy approach meant to enable the South Asian giant's rise in the international system has also been marked with fluctuations instead of the other — arguably weaker and less effective — more constant components of diplomacy such as cultural diplomacy.

The proverbial *Achilles Heel* in terms of India integrating S&T Diplomacy as a concept that yields practical dividends to serve state interests might actually lie outside of the foreign policy community and may further run worryingly deep into the S&T workforce instead. While Indian states-persons, diplomats and foreign policy experts may have begun to show a growing awareness of the role of S&T in the country's foreign policy there is little, if any, substantial evidence that its scientists and technicians in the country have begun to show any collective appreciation to understanding the foreign policy implications of their own work beyond a select few noteworthy exceptions.[59]

India's S&T universities — in a time-honed tradition — continue to impart S&T education with very little additional content on language and social sciences, including the country's own foreign policy. This inevitably gives rise to a class of specialized S&T human resources

[59]The author of this study visited one of the country's premier private-sector educational institutes for space science and technology for research fieldwork purposes only to find that whilst the faculty there had an advanced working knowledge of space S&T, it was also under-equipped to deal with the question of how space S&T impacts foreign policy. The author of this study also holds a Bachelor's in Electronics and Communications Engineering from a state university in India and came across subjects such as English and Economics during his own studies but there were no foreign policy courses for learning, pursuit and completion — even optionally available — by the time he completed his degree with honors in 2008.

who normally have a scant idea about the country's foreign policy leave alone the role of their areas of specialization in it. This condition translates into a potent impediment for S&T Diplomacy since the country's Science Counselors come from mainly an S&T background, and lack the ability to discharge their duties in stations abroad given their limited understanding of India's foreign policy objectives, or even basic political science or IR. Thus, there is a need to introduce introductory courses on foreign policy and — ideally S&T Diplomacy — in India's higher-education S&T institutions at the university level to verse the students in these concepts.

Increased focus on developing globally competitive human resources in the Science and Technology sector within the country — as well as attracting talent from outside — is essential for the rise of Science and Technology as a component of Indian national power.

The domestic research environment in India at a university level is marked with a tendency to train students in tents of existing education rather than to provide for an environment which is connected to the country's larger research nodes in the public and private sectors for giving rise to innovation. This leads to the creation of a pool of specialists who might not necessarily possess the skills required for being competitive on an international level. As early as 2004, Paarlberg (139-145) noted that the US scientific advantage in the international system — critical to its national security — existed primarily due its ability to attract and retain new and competent STEM workforce from across the world. India's case is one in which an already imperfect research environment is further complicated by the migration of its skilled STEM workforce. Thus the country must put in incentives for attracting scientifically and technically adept members from its diaspora back to the land of their ancestral origin to ensure that it benefits from their experience.

Since its 1991 economic reforms, India has made conscious efforts to reach out to its diaspora — in order to secure greater engagement from it in its own national interest — from regions of critical value to global S&T such as the 'Silicon Valley' in the US. However, relying on diaspora alone may not be sufficient in the contemporary era. There are other states in the international system — particularly India's partners from the Global South — which also harbor human resources of potentially critical value to the country's national

progress. New Delhi thus must ideally make further and earnest efforts to attract workforce from all available international sources to aid innovation and drive its national progress.

India has to apportion more resources and attention at the central, state and university levels to enable a globally competitive STEM ecosystem.

S&T related R&D in India exists at the central, state and university levels. At the central level, India has to apportion a larger percentage of its national budget to S&T — ideally as close to 3% as possible to further enable its rise on the global S&T landscape. Indian public sector entities such as HAL and DRDO have also been functioning for long without meeting national demands despite favorable budget allocations and this needs course-correction. However, India also has a federal administrative structure. The country's states have fallen short of spending on S&T related R&D — adversely impacting its reliant diplomacy. India's states have to ideally invest more on R&D to give rise to a truly competent national STEM ecosystem for the country.

Beyond the center and the states, Indian universities act more as centres of imparting already existing knowledge instead of acting as hubs of creating new knowledge and spurring innovations with links to the national and international STEM innovation hubs. This may be even more true for many state universities since they are traditionally ranked lower in terms of research output than their more eminent central counterparts. This state has to be corrected by allocation of more funds specifically meant for nationally connected innovation to add to the R&D capabilities at a university level.

The domestic environment in India has to be made aware of the sensitivities of the country's Science and Technology Diplomacy.

India's S&T Diplomacy fails when projects aided by its trusted strategic partner Japan to enable its own national development face delays within its own borders due to domestic politics or when New Delhi's own soft power projects such as South Asian University and Nalanda University face domestic hurdles due to its labyrinthine web of regulations. The country's standing in the international system stands to be diminished when its own

politicians vocally call to question extensions of Lines of Credit to potentially key partners in the international system such as Mongolia. That India is a democracy is known to its foreign policy establishment which leads deliberations in S&T Diplomacy. But there has to ideally exist a bipartisan consensus on insulating the country's S&T Diplomacy calculations from the machinations of domestic politics.

India further has to look beyond the optics of a domestically popular state-run space programme in favor of a more competitive space sector that can secure the country a greater market share in the global space economy. Even during the contemporary era — nearly three decades after the 1991 economic reforms — India's private sector struggles to provide the country with a competent S&T supply chain given a yet-existing labyrinth of regulations and monopoly of state-run entities such as ISRO. Furthermore, India's domestic dynamics make it stiflingly difficult for foreign S&T enterprises to enter, operate and profit from the market to induce not only product development but also healthy competition. This has implications for its S&T industry and — in turn — S&T Diplomacy which is tied to Indian goods and services.

India needs an effective development diplomacy policy for ensuring timely delivery of S&T projects outside its borders.

Despite its limitations, India has employed its S&T assets to achieve larger foreign objectives — and this diplomatic outreach has seen a measure of success with the core representative example being that of its successful ITEC programme, which remains highly sought-after by its partners from the Global South to this day.

However, the country's S&T Diplomacy also falls short of achieving its true potential when its projects in its Himalayan neighbor Nepal — often accompanied by high octane promises — fail to materialize even decades after their inception due to New Delhi's lethargy, apathy and inertia, understandably inviting both ridicule and even scorn instead of amity and also ceding ground for its strategic competitors such as China to take due advantage.

India has to be cautious in entering international commitments — and even more cautious to deliver in time once an agreement is reached with another entity in the international system — else S&T Diplomacy can serve to *undermine* its state interests instead of *aiding* them.

India must make maximum use of its most conducive strategic partnerships to actualize its national scientific and technological interests. In this regard, country studies for the scientific, technological and foreign policy communities would aid India's national interests.

21st Century India has built a series of strategic partnerships — preferred by a New Delhi averse to full treaty alliances in order to safeguard its strategic autonomy in the international system — with diverse states such as the UAE, Israel, Russia, the US, Singapore, South Korea and Japan. These strategic partnerships come with S&T benefits in India's own national interest. India has already reaped benefits from each of its strategic partnerships with its more advanced counterparts in the international system and has further enabled its strategic partners to pursue common global objectives of mutual interest. However, India's own expertise in terms of country studies with respect to its diverse strategic partners might be in need of further attention.

India stands to realize the full potential of its diverse strategic partnerships by vigorously embarking on a detailed country studies programme on its strategic partners — covering not only their political, social, legal and technological landscape but also extending to historical and linguistic studies. Linguistic studies would enable Indian human resources to access S&T in the geographical confines of its strategic partners who do not produce all their knowledge in the English language, such as Japan and South Korea — potentially opening avenues for greater access and collaboration. Historical studies would enable Indian human resources to operate with greater familiarity to their host environments whilst in quest of S&T. This may be crucial since 21st Century India's S&T Diplomacy cannot thrive in an environment where only a limited circle of its own experts understand the language, culture, history or the overall environment of its diverse strategic partners.

India has to actively reconcile national interests in its strategy with global issues and challenges. India's multiple strategic partnerships might further come to be in conflict with each other — with implications for its Science and Technology Diplomacy.

India is in a unique position of being a rising power having to contend with objectives of national interest and also those meant to address global issues and challenges, and these might often turn out to difficult to reconcile in practice. For example, India is a signatory to the Paris Agreement and has taken the lead in the International Solar Alliance initiative. But the country is still dependent on traditional, carbon-based fuel to meet much of its energy requirements. India has also traditionally opposed militarization of space but is decisively moving towards it itself. Contradictions such as these will have to be ably addressed in the near future to enable the country's rise in the international system.

The extent to which India can continue to benefit from S&T cooperation with strategic partners who also rival each other in the international system — such as the US and Russia — might impact its future calculations in critical areas such as space and defense technology. Thus, the understanding of the foreign policy implications of S&T Diplomacy initiatives among the country's intelligentsia becomes even more paramount in the 21st Century.

India's pursuit of its Indo-Pacific and Act East policies stands to benefit from closer S&T cooperation with its strategic partners.

In the 21st Century, China has impeded India's entry to the NSG and has aided its South Asian rival Pakistan. Both countries have also seen border skirmishes in May 2020. China has further taken to the Belt and Road Initiative (BRI) and the String of Pearls strategy, both of which stand to threaten India's vital national interests. India stands to benefit from generating an international alterative to BRI in favor of its *Act East* and *Indo-Pacific* policies in the form of the AAGC in conjunction with China's Asian rival Japan.

However, the AAGC alone might not enough for India to check China's rise. New Delhi has existing triangular cooperation mechanisms with fellow democratic strategic partners in Portugal, Israel, Netherlands, Singapore, South Korea, the US and the UK. India must embark

on deeper triangular S&T cooperation — including in the domain of space in partnership with strategic partners such as Japan — to provide non-intrusive, cost-effective yet beneficent alternatives to developing states that seek to potentially engage China through BRI. Working with multiple partners in multiple theatres across the Indian Ocean Region and South-East Asia will be crucial for the future of India's state interests.

Furthermore, the Quad has now come to fore as a potent international mechanism of its own with scope for additional like-minded states willing to cooperate with an intention for balancing an increasingly hegemonic China through S&T, including health diplomacy, during the ongoing COVID-19 pandemic. India stands to secure its national interests while also providing for collective security of its many strategic partners in the Indo-Pacific and beyond through this cooperation.

New Delhi has to device a coherent national strategy to answer to new, emerging and disruptive technologies without being left behind in terms of global innovation.

India traditionally lagged behind international advances in both nuclear and space technologies during the 20th Century — and was humiliated through denial by its more powerful counterparts in the international system as an outcome. The country had also fallen behind the internet and the smartphone revolutions although it had remained relatively unscathed in terms of reputational consequences. Albeit with the rise of disruptive technologies in the 21st Century such as Artificial Intelligence, the country's vulnerabilities have only grown despite its meagre attempts to address the gap between domestic and global ICT advances.

India has taken a measure of cognizance of the problem with the establishment of the New Emerging & Strategic Technologies and the Cyber Diplomacy divisions within the country's MEA. However, the country still has its dedicated S&T Counselors serving only in select stations abroad in Germany, Japan, Russia and USA. India has to take further steps to access global S&T to not stay one innovation cycle behind the global leaders and this has to ideally manifest through both internal and external balancing.

India's COVID-19 diplomacy has been visible at the world stage. The country must now make further efforts towards staying the course during the closing moments of the ongoing global pandemic.

India's efforts at aiding not only its existing strategic partners but also other states through the ongoing global pandemic are likely to raise its value as a reliable partner in the international system. However, like other shocks before the COVID-19 crisis — this chapter in collective human misery will end as well. And there will be a post-COVID-19 international system which potentially stands to yield opportunities for India to further enable its rise. But the opportunities will have to be seized in due earnest by the country's leadership in New Delhi.

As circumstances stand now, India has both emerged as a credible provider of COVID-19 vaccines to the international system but has also had to halt its outbound vaccine diplomacy partially due to disruptions originating from outside its borders and further given the needs of its own population. India will ideally have to see this crisis through in a way that suits both its national needs and international ambitions.

Then there are questions of a post-COVID-19 international system which involves India's role. India stands to benefit from the ongoing crisis despite early shocks by integrating itself to a greater degree to the global supply chain. This has to be ideally done in an environment that allows for greater freedom to trade and navigate through the country's labyrinthine legal, bureaucratic and regulatory systems. Thus there are structural reforms required from within to urgently occupy as much space in the global supply chain as possible.

Thesis Conclusion

The study of relationship between S&T and International Relations remained largely muted in academia through much of the last century — despite some scholarly attention being granted to select silos such as military or nuclear technology or to select states such the US

and Japan. Since the rise of the concept of Science Diplomacy though the efforts of organizations such as the Royal Society and American Association for the Advancement of Science, and also through notable efforts of scholars such as Dr. Nina V. Fedoroff — things have improved for the study of S&T Diplomacy in the 21st Century. But the overall attention devoted to S&T Diplomacy in IR studies yet remains sparse.

This condition also translates to sparse academic attention allocated to many national models of S&T Diplomacy. This lack of scholarly attention remains particularly inexplicable for states such as India, given that the country's leadership has might have pursued its own version of S&T Diplomacy since its independence from the British Empire in 1947. India's energetic activities falling under the domain of S&T Diplomacy to address its national and foreign policy interests emerged even more convincingly with its rise in the 21st Century.

The rise of New Delhi as a donor of S&T in global development assistance and as a state capable of offering global solutions in such advanced areas such as space technology is a reality that has thus far remained muted in international academic circles even in the 21st Century. Despite recent academic advances made by organizations such as the Research and Information System for Developing Countries — studies of India's Science Diplomacy, Technology Diplomacy and S&T Diplomacy have yet been limited both in terms of length and scholarly impact.

This condition is remarkable since New Delhi itself has shown both a declared intention and a visible movement towards pursuing its state interests through its S&T Diplomacy strategy in the 21st Century. It already has dedicated and specialized personnel, institutions and resources to address the task of S&T Diplomacy — and has engaged with its many strategic partners in the international system to address both its national and external interests as well as global challenges through S&T. Furthermore, primary sources for situating the contours of India's S&T Diplomacy have existed in the plain sight in the public domain since the world's largest democracy has opened up a healthy extent of its state document archives for public perusal as evidenced in Appendix 1 of this study.

An attempt to add to the limited body of research on the subject of India's S&T Diplomacy was made through this study. Unlike the few and previous full-length contributions that address this subject — this study sought to field a clearly-declared original research question, clearly-articulated hypotheses, and full aims and objectives with two detailed case studies instead of addressing multiple areas in a relatively cursory manner. Prior to arriving at this conclusion, this study also fielded recommendations for optimal conditions for the role of S&T Diplomacy in Rising India's foreign policy in the 21st Century. This unique mix adds a definitive originality to this study.

But this sole attempt — given its inherently limited nature as a modest PhD thesis — will also certainly not be sufficient in the grand scheme of things. A country with several declarations of utilizing S&T for state and foreign policy objectives requires several more studies to fully address details. However, this study — focused on S&T Diplomacy in development assistance and the space sector — has made one such humble and humane effort to bring greater focus on the subject. And — given India's slow but consequential rise in the international system — it is hoped that future studies add more value to the field.

India's S&T Diplomacy remains — in many aspects — a study in contradictions. The country was able to send successful missions to distant stations such as the Moon and Mars but has yet to ensure the timely completion of ordinary development assistance projects in its neighboring states. The country boasts of a large S&T workforce and a small but highly specialized group of Indian Foreign Service personnel but has yet to field a credible group of specialized Science Counselors in more than a select few stations abroad. The country has faced technology denials in the past; continues to face opposition from China in terms of its efforts to enter the NSG in the contemporary era; and has endured emergence of new and disruptive technologies originating from elsewhere but has yet to find the urgency to devote even two percent of its GDP to S&T-related R&D.

However, like the proverbial elephant which symbolizes the country in popular imagination — India moves slowly but also decisively. And its S&T Diplomacy remains a cautious exercise in statecraft without any notable abrupt movements. The future of India's S&T Diplomacy in the international system will be worth following. It is sincerely hoped that the assertions

made through the study will inform future research efforts at least in part to further contribute to the field.

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Appendices

Appendix 1

This research has benefited from a range of primary sources that are available online. This section thus lists the sources that are available online for the study of Indian foreign policy.

1) India's Foreign Relations - Documents (2003-13) (ed., Avtar Singh Bhasin):

- 2003: http://geetikapublishers.com/PDF/2003.pdf
- 2004: http://mea.gov.in/Uploads/PublicationDocs/187_Foreign-Relations-2004.pdf
- 2005: https://mea.gov.in/Uploads/PublicationDocs/186_foreign-relations-2005.pdf
- 2006: http://mea.gov.in/images/pdf/main_2006.pdf
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- 2012: https://mea.gov.in/Images/pdf/India-foreign-relation-2012.pdf
- 2013: https://mea.gov.in/Uploads/PublicationDocs/25403_India_foreign_relation_2013.pdf

2) Abilekh Patal: http://abhilekh-patal.in/jspui/

3) National Digital Library of India: https://ndl.iitkgp.ac.in

4) Prime Minister's Office Archives: https://archivepmo.nic.in/index.html

5) The President of India Website: https://presidentofindia.nic.in/index.htm

6) Press Information Bureau Archives (1947-2001): http://pibarchive.nic.in/archive/phase2/archiveministry.aspx?phase=3

7) Parliamentary Committees: http://loksabhaph.nic.in/Committee/CommitteeHome.aspx

8) MEA's Bilateral/Multilateral Documents: https://mea.gov.in/bilateral-documents.htm?53/Bilateral/Multilateral_Documents

9) MEA's Indian Treaties Database: https://mea.gov.in/treaty.htm

10) Nehru Portal: https://nehruportal.nic.in

11) MEA's Annual Reports (1948-49 to 2009-10): https://mealib.nic.in/?2386?000 .

12) MEA's Annual Reports (1999-2000 to the present): https://mea.gov.in/annual-reports.htm?57/Annual_Reports

13) MEA's Foreign Affairs Records (1955-99): https://mealib.nic.in/?2588?000

14) US Office of the Historian: https://history.state.gov .

15) Wilson Center Digital Archives: https://digitalarchive.wilsoncenter.org

Appendix 2

Copies of questionnaires for primary research for this study are given below:

Questions on Science and Technology (S&T) Diplomacy in Indian Foreign Policy

How would you situate S&T Diplomacy as an Instrument of Indian Foreign Policy prior to the 21st Century?

- What are your views on the role of S&T Diplomacy in Indian foreign policy prior to the 21st Century?
- What are your views on the financial wherewithal that S&T Diplomacy enjoyed in Indian foreign policy prior to the 21st Century?
- What are your views on the level of integration that S&T Diplomacy had with Indian foreign policy prior to the 21st Century?

How do you situate S&T Diplomacy as an Instrument of Rising India's Foreign Policy in the 21st Century?

- What are your views on the mechanisms of cooperation that bind S&T Diplomacy with Rising India's foreign policy in the 21st Century?[60]
- What are your views on the financial wherewithal that S&T Diplomacy enjoys in Rising India's foreign policy in the 21st Century?
- Are you satisfied with the level of integration that S&T Diplomacy has with Rising India's foreign policy in the 21st Century?

What factors do you perceive as being impediments to India realizing its full potential as a Rising Power in the domain of S&T Diplomacy as an instrument of foreign policy in the 21st Century?

[60]Mechanisms of cooperation imply formal bilateral/multilateral agreements with states and transnational groupings as well as the ad-hoc approach peculiar and unique to the incumbent Indian administration.

What are the opportunities that you see for India in terms of the Rising Power realizing its full potential in the domain of S&T Diplomacy as an instrument of foreign policy in the 21st Century?

What are your recommendations for a Rising India to realize its full potential in the domain of S&T Diplomacy as an instrument of foreign policy in the 21st Century?

Science and Technology (S&T) Diplomacy for Foreign Policy: Rising India's S&T-based Developmental Assistance in the 21st Century

How has S&T traditionally contributed to India's developmental assistance prior to the 21st Century?

What tangibles do India's S&T-based developmental assistance capabilities achieve for a Rising India's foreign policy objectives in the 21st Century?

- What are your views regarding the mechanisms of cooperation that bind S&T-based developmental assistance with Indian foreign policy in the 21st Century?
- What are your views regarding the financial wherewithal that S&T-based developmental assistance enjoys in Indian foreign policy in the 21st Century?
- Are you satisfied with the level of integration that S&T-based developmental assistance has with Indian foreign policy in the 21st Century?

What are the most notable limitations and constraints — both internal and external — that a Rising India faces to conduct meaningful S&T-based Development Diplomacy in service of its foreign policy objectives?

What are your recommendations to correct these limitations and constraints in a Rising India?

Beyond Stars: Space Diplomacy in Service of a Rising India's Foreign Policy Objectives in the 21st Century

How have India's capabilities in the domain of outer space technology changed in the 21st Century when compared to the previous era?

How does Rising India's Space Diplomacy enable the state to realize its foreign policy objectives in the 21st Century?

- What are your views regarding the mechanisms of cooperation that bind Space Diplomacy with Indian foreign policy in the 21st Century?
- What are your views regarding the financial wherewithal that Space Diplomacy enjoys in Indian foreign policy in the 21st Century?
- Are you satisfied with the level of integration that Space Diplomacy has with Indian foreign policy in the 21st Century?

What are the most notable limitations and constraints — both internal and external — that a Rising India faces to conduct meaningful Space Diplomacy in service of its foreign policy objectives in the 21st Century?

What are your recommendations to correct these limitations and constraints in a Rising India?

Appendix 3

Government of India - Lines of Credit Statistics for Asia between FY 2002-03 and 2019-20 according to the Exim Bank of India (2020) as found on 2 March 2020.

S.No.	Year of Approval	Region	Country	Borrower	Amount of Credit (in USD mn)	Purpose	Date of signing of LOC by the recipient with Exim Bank
1	2002-03	Asia	Iran	Seven Iranian Banks, Iran	87.85	Purchase of capital goods and related services	25-01-2003
2	2003-04	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	7.00	Establishment of an OFC link between Moreh and Mandalay, an ADSL high-speed data link in Yangon area and a reduced number of COR-DECT lines	21-10-2004
3	2003-04	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	56.36	Railway rehabilitation	27-07-2004
4	2003-04	Asia	Syria	Government of Syria	25.00	Development and modernization of steel plant in Hama	05-06-2008
5	2003-04	Asia	Vietnam	Government of Vietnam	27.00	General purpose - Contracts approved include export of textile machinery, equipment and services for hydro power projects	12-08-2004
6	2004-05	Asia	Sri Lanka	Ceylon Petroleum Corporation, Sri Lanka	150.00	Export of petroleum products by MRPL	15-10-2004
7	2005-06	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	20.00	Renovation of Thanlyin Refinery	17-08-2006
8	2005-06	Asia	Sri Lanka	Government of Sri Lanka	100.00	Purchase of equipment/ supplies	31-03-2008
9	2006-07	Asia	Lao PDR	Government of Lao PDR	17.34	Development of Irrigation schemes in the Champassack Province	20-02-2009
10	2006-07	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	60.00	Railway projects by RITES Ltd.	29/10/2007 and 27/07/2010

11	2006-07	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	20.00	Setting up an assembly/manufacturing plant for assembly and manufacturing of Tata vehicles	24-06-2008
12	2006-07	Asia	Nepal	Government of Nepal	100.00	Road projects, rural electrification projects, power transmission projects and hydro power projects	14-09-2007
13	2006-07	Asia	Vietnam	Government of Vietnam	45.00	NAM Chien Hydropower Project (200 MW) at Son La Province	08-01-2008
14	2007-08	Asia	Cambodia	Government of Cambodia	35.20	Stung Tasal development project by WAPCOS, purchase of water pumps, construction of electricity transmission line between Kratie and Stung Treng by WAPCOS	08-12-2007
15	2007-08	Asia	Cambodia	Government of Cambodia	15.00	Strengthening the capacity of transmission line project between Kratie and Stung Treng	01-03-2010
16	2007-08	Asia	Lao PDR	Government of Lao PDR	33.00	Paksong S/S – Jiangxai 115 KV, double circuit Transmission Line Project , Nam Song 7.5 MW hydropower project and Equipment for Rural electrification Phase 2 Project	27-08-2008
17	2007-08	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	64.07	(i) Oakshitpin – Thahtay Chaung – Taungup 230 kV Transmission Line and Substation Project; (ii) Taungup – Maei – Ann – Mann 230 kV Transmission Line and Substation project; and (iii) Maei – Kyaukpyu 230 kV Transmission Line and Substation project	24-06-2008
18	2007-08	Asia	Vietnam	Government of Vietnam	19.50	Two projects	11-07-2013
19	2008-09	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	20.00	Upgradation of Thanbayakan Petrochemical Complex	17-02-2009
20	2008-09	Asia	Sri Lanka	Government of Sri Lanka	99.77	Upgradation of railway line (Colombo-Matara)	23-07-2008

21	2009-10	Asia	Bangladesh	Government of Bangladesh	862.00	Financing export of goods and projects including development of railway infrastructure, dredging, construction of bridges, procurement of buses, locomotives, coaches and rehabilitation of Saidpur Workshop.	07-08-2010
22	2009-10	Asia	Mongolia	Government of Mongolia	20.00	India-Mongolia Joint Information Technology Education & Outsourcing Center (IMJIT) Project	14-02-2012
23	2009-10	Asia	Sri Lanka	Government of Sri Lanka	67.36	Upgradation of Southern Railway Corridor from Colombo to Matara	10-03-2010
24	2009-10	Asia	Sri Lanka	Government of Sri Lanka	416.38	(I) Track laying by IRCON on the Omanthai-Pallai sector, (II) Track laying by IRCON on the Madhu Church-Tallaimannar sector, and (III) Track laying on the Medawachchiya- Madhu railway line	26-11-2010
25	2009-10	Asia	Syria	Government of Syria	100.00	Partly finance Tishreen Thermal Power Project (2 x 200 MW) by BHEL	07-10-2009
26	2010-11	Asia	Cambodia	Government of Cambodia	15.00	Completion of Stung Tasal Water Development Project	14-09-2010
27	2010-11	Asia	Lao PDR	Government of Lao PDR	72.55	(I) 230 kV Double Circuit Transmission Line from Nabong to Thabok and substations (USD 34.68 million), (II) Improvement and Expansion of 22kV distribution line in Vientiane capital city branches project [USD 35.25 million] in Lao PDR	13-09-2010
28	2010-11	Asia	Maldives	Government of Maldives	40.00	Construction of 500 housing units	12-08-2011
29	2010-11	Asia	Nepal	Government of Nepal	250.00	Financing infrastructure projects such as highways, airports, bridges and irrigation projects	21-10-2011
30	2010-11	Asia	Sri Lanka	Government of Sri Lanka	382.37	(I) Track laying on the Pallai-Kankesanthurai railway line, (II) Setting up of signaling and telecommunications systems for the Northern railway line and (III) other projects as may be approved by Government of India (USD	17-01-2012

31	2012-13	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	198.96	16 ongoing irrigation schemes and 2 rehabilitation schemes in the irrigation project in Myanmar	11-12-2013
32	2013-14	Asia	Cambodia	Government of Cambodia	36.92	Stung Sva Hab/Slab Water Resources Development Project	27-01-2018
33	2013-14	Asia	Lao PDR	Government of Lao PDR	30.94	Construction of Storage Dams & Development of Irrigation Systems in four major provinces in Lao PDR	09-09-2013
34	2013-14	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	86.31	Procurement of rolling stock, equipment and up-gradation of three major Railway Workshops by procurement of machinery	11-12-2013
35	2014-15	Asia	Myanmar	Myanma Foreign Trade Bank, Myanmar	6.20	Implementation of a Microwave Radio Link on the Rhi-Mindat route in Myanmar	22-05-2015
36	2014-15	Asia	Nepal	Government of Nepal	550.00	Hydropower, Irrigation and Infrastructural development projects	25-Nov-14/16-Sep-16
37	2014-15	Asia	Sri Lanka	Government of Sri Lanka	318.00	For financing procurement of i) Procurement of rolling stock for Sri Lankan Railways (USD 177 mn); (ii) Up-gradation of railway tracks (Maho-Anuradhapura-Omanthai or any other sector) (USD 136 mn); (iii) Utilisation of balance amount, if any, as may be agreed to between Borrower (GOSL) and GOI.	06-06-2017
38	2014-15	Asia	Vietnam	Government of Vietnam	100.00	Purchase of equipment / supplies	15-09-2014
39	2015-16	Asia	Bangladesh	Government of Bangladesh	2,000.00	Financing various social and infrastructure development projects in Bangladesh [such as power, railways, road transportation, information and communication technology, shipping, health and technical education sectors]	09-03-2016
40	2015-16	Asia	Nepal	Government of Nepal	750.00	For Post earthquake rehabilitaion projects	16-09-2016

51	2019-20	Asia	Mongolia	Government of Mongolia	236.00	Petrochemical Refinery Project of Mongolia	09-10-2019
52	2019-20	Asia	Sri Lanka	Government of Sri Lanka	400.00	Development and Infrastructure Projects	Not yet signed
				Total	**15,428.75**		

Appendix 4

India's outbound supply of vaccines on grant, commercial and COVAX basis by 6 April 2021 — as per the Ministry of External Affairs, Government of India (2021).

Vaccine Supply

Made-in-India COVID19 vaccine supplies so far (In lakhs)

(As on 06 April 2021 at 1800 hrs)

Sl. No.	Country	Grant		Commercial		COVAX		Total Supplies
		Quantity	Date of Despatch	Quantity	Date of Despatch	Quantity	Date of Despatch	
1	Bangladesh	33	(20) 21-Jan-21 (12) 26-March-21 (1) 2-Apr-21	70	50 25-Jan-21 20 22-Feb-21			103
2	Myanmar	17	(15 SII) 22-Jan-21 (2 BB) 11-Feb-21	20	11-Feb-21			37
3	Nepal	11	(10) 21-Jan-21 (1) 28-Mar-21	10	20-Feb-21	3.48	05-Mar-21	24.48
4	Bhutan	5.5	1.5 20-Jan-21 4 21-Mar-21					5.5
5	Maldives	2	1 20-Jan-21 1 19-Feb-21	1	29-Mar-21	0.12	06-Mar-21	3.12
6	Mauritius	1	22-Jan-21	3	(1 SII) 19-Feb-21 (2 BB) 18-Mar-21			4
7	Seychelles	0.5	22-Jan-21					0.5
8	Sri Lanka	5	28-Jan-21	5	24-Feb-21	2.64	06-Mar-21	12.64
9	Bahrain	1	28-Jan-21					1
10	Brazil			40	20 22-Jan-21 20 22-Feb-21			40
11	Morocco			70	20 22-Jan-21 40 11-Feb-21 10 24-Feb-21			70
12	Oman	1	30-Jan-21					1
13	Egypt			0.5	30-Jan-21			0.5
14	Algeria			0.5	31-Jan-21			0.5
15	South Africa			10	31-Jan-21			10
16	Kuwait			2	31-Jan-21			2
17	UAE			2	2-Feb-21			2
18	Afghanistan	5	7-Feb-21			4.68	06-Mar-21	9.68
19	Barbados	1	7-Feb-21					1
20	Dominica	0.7	7-Feb-21					0.7

21	Mexico			8.7	12-Feb-21			8.7
22	Dominican Republic	0.3	18-Feb-21	0.2	14-Feb-21			0.5
23	Saudi Arabia			45	30 14-Feb-21 15 28-Mar-21			45
24	El Salvador			0.2	15-Feb-21			0.2
25	Argentina			5.8	16-Feb-21			5.8
26	Serbia			1.5	20-Feb-21			1.5
27	UN Health workers			1	21-Feb-21			1
28	Mongolia	1.5	21-Feb-21					1.5
29	Ukraine			5	22-Feb-21			5
30	Ghana	0.5	4-Mar-21	0.02	10-Mar-21	6	23-Feb-21	6.52
31	Ivory Coast	0.5	4-Mar-21			5.04	25-Feb-21	5.54
32	St. Lucia	0.25	27-Feb-21					0.25
33	St. Kitts & Nevis	0.2	27-Feb-21					0.2
34	St. Vincent & Grenadines	0.4	27-Feb-21					0.4
35	Suriname	0.5	27-Feb-21					0.5
36	Antigua & Barbuda	0.4	27-Feb-21					0.4
37	DR Congo	0.5	4-Mar-21			17.16	1-Mar-21	17.66
38	Angola					6.24	1-Mar-21	6.24
39	Gambia					0.36	1-Mar-21	0.36
40	Nigeria	1	25-March-21			39.24	1-Mar-21	40.24
41	Cambodia					3.24	2-Mar-21	3.24
42	Kenya	1	10-Mar-21			10.20	2-Mar-21	11.20
43	Lesotho					0.36	2-Mar-21	0.36
44	Rwanda	0.5	4-Mar-21			2.40	2-Mar-21	2.9
45	Sao Tome & Principe					0.24	2-Mar-21	0.24
46	Senegal	0.25	4-Mar-21			3.24	2-Mar-21	3.49
47	Guatemala	2	2-Mar-21					2

48	Canada			5.00	2-Mar-21			5.00
49	Mali					3.96	3-Mar-21	3.96
50	Sudan					8.28	3-Mar-21	8.28
51	Liberia					0.96	4-Mar-21	0.96
52	Malawi	0.5	12-Mar-21			3.60	4-Mar-21	4.1
53	Uganda	1.00	7-Mar-21			8.64	4-Mar-21	9.64
54	Nicaragua	2.00	5-Mar-21			1.35	14-Mar-21	3.35
55	Guyana	0.8	5-Mar-21					0.8
56	Jamaica	0.50	5-Mar-21					0.50
57	UK			50	5-Mar-21			50.00
58	Togo					1.56	5-Mar-21	1.56
59	Djibouti					0.24	5-Mar-21	0.24
60	Somalia					3.00	5-Mar-21	3.00
61	Seirra Leone					0.96	6-Mar-21	0.96
62	Belize	0.25	7-Mar-21					0.25
63	Botswana	0.30	7-Mar-21					0.30
64	Mozambique	1.00	7-Mar-21			3.84	7-Mar-21	4.84
65	Ethiopia					21.84	7-Mar-21	21.84
66	Tajikistan					1.92	8-Mar-21	1.92
67	Benin					1.44	8-Mar-21	1.44
68	Eswatini	0.20	9-Mar-21			0.12	11-Mar-21	0.32
69	Bahamas	0.20	10-Mar-21					0.20
70	Cape Verde					0.24	9-Mar-21	0.24
71	Iran			1.25	(BB)10-Mar-21			1.25
72	Uzbekistan					6.60	15-Mar-21	6.60
73	Solomon Islands					0.24	17-Mar-21	0.24
74	Laos					1.32	17 Mar-21	1.32
75	Namibia	0.30	18-Mar-21					0.30
76	Bolivia					2.28	18 Mar-21	2.28
77	South Sudan					1.32	22 Mar-21	1.32
78	Paraguay	1.00	(1 BB) 26 Mar 2021					1.00
79	Fiji	1.00	26 Mar 2021					1.00
80	UN Peacekeepers	2.00	27-Mar-21					2.00
81	Zimbabwe	0.35	(0.35 BB) 28 Mar 2021					0.35
82	Niger	0.25	28 Mar 2021					0.25
83	Palestine			0.25	29 Mar-21			0.25
84	Yemen					3.60	29 Mar-21	3.60
	Total	**105.15**		**357.92**		**181.95**		**645.02**

Appendix 5

Details of space research centres in India according to Union Minister of State in the Department of Space and Department of Atomic Energy Dr. Jitendra Singh (2021). Information in Hindi language rendered in Devanagari script.

भारत सरकार
अंतरिक्ष विभाग
लोक सभा
अतारांकित प्रश्न संख्या : 1409

बुधवार, 10 फरवरी, 2021 को उत्तर देने के लिए
अंतरिक्ष अनुसंधान केंद्र

1409. **श्री हरीश द्विवेदी:**

क्या **प्रधान मंत्री** यह बताने की कृपा करेंगे कि :

(क) वर्तमान में देश में अंतरिक्ष अनुसंधान केंद्रों की संख्या कितनी है और तत्संबंधी स्थान कौन से हैं;

(ख) क्या देश में और अधिक अंतरिक्ष अनुसंधान केंद्रों की स्थापना करने का कोई प्रस्ताव है; और

(ग) यदि हां, तो तत्संबंधी ब्यौरा क्या है?

उत्तर
कार्मिक, लोक शिकायत और पेंशन मंत्रालय
तथा प्रधान मंत्री कार्यालय में राज्य मंत्री
(डॉ. जितेन्द्र सिंह) :

(क) स्थानों सहित अंतरिक्ष अनुसंधान केंद्र निम्नानुसार हैं:

क्र.सं.	केंद्र	स्थान
01.	विक्रम साराभाई अंतरिक्ष केंद्र (वी एस एस सी)	तिरुवनंतपुरम
02.	द्रव नोदन प्रणाली केंद्र (एल पी एस सी)	बैंगलुरु और वलियमला, तिरुवनंतपुरम
03.	सतीश धवन अंतरिक्ष केंद्र (एस डी एस सी, शार)	श्रीहरिकोटा
04.	यू आर राव उपग्रह केंद्र (यू आर एस सी)	बैंगलुरु
05.	अंतरिक्ष उपयोग केंद्र (सैक)	अहमदाबाद
06.	राष्ट्रीय सुदूर संवेदन केंद्र (एन आर एस सी)	हैदराबाद
	5 क्षेत्रीय सुदूर संवेदन केंद्र	जोधपुर, दिल्ली, नागपुर, कोलकाता, बैंगलुरु
07.	समानव अंतरिक्ष उड़ान केंद्र (एच एस एफ सी)	बैंगलुरु
08	इसरो नोदन कॉम्प्लेक्स (आई पी आर सी)	महेंद्रगिरि
09	इसरो जड़त्वीय प्रणाली यूनिट (आई आई एस यू)	तिरुवनंतपुरम
10	विकासात्मक एवं शैक्षिक संचार यूनिट (डेकू)	अहमदाबाद

11	मुख्य नियंत्रण सुविधा (एम सी एफ)	हासन, कर्नाटक और भोपाल, मध्य प्रदेश
12	इसरो दूरमिति, अनुवर्तन और आदेश नेटवर्क (इस्ट्रैक)	बैंगलुरु लखनऊ एवं पोर्ट ब्लेयर
13	विद्युत-प्रकाशिकी प्रणाली प्रयोगशाला (लियोस)	बैंगलुरु
14	भारतीय सुदूर संवेदन संस्थान (आई आई आर एस)	देहरादून
15	भौतिक अनुसंधान प्रयोगशाला (पी आर एल)	अहमदाबाद
16	राष्ट्रीय वायुमंडलीय अनुसंधान प्रयोगशाला (एन ए आर एल)	तिरुपति
17	उत्तर पूर्वी अंतरिक्ष उपयोग केंद्र (उ.पू.-सैक)	शिलौंग
18	सेमी-कंडक्टर प्रयोगशाला (एस सी एल)	चंडीगढ़
19	भारतीय अंतरिक्ष विज्ञान और प्रौद्योगिकी संस्थान (आई आई एस टी)	तिरुवनंतपुरम
20	एंट्रिक्स कारपोरेशन लिमिटेड	बैंगलुरु
21	न्यू स्पेस इंडिया लिमिटेड (एन एस आई एल)	बैंगलुरु

(ख) और (ग)

इसरो टूटिकोरिन (तमिलनाडु) में एक नए प्रमोचन पैड पर काम कर रहा है। भूमि अधिग्रहण का कार्य प्रगति में हैं, तत्पश्चात इस परियोजना के पूरा होने में 24 माह का समय लग सकता है।

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